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COMPUTER Answers

SOLVES YOUR MICRO QUERIES & PROBLEMS

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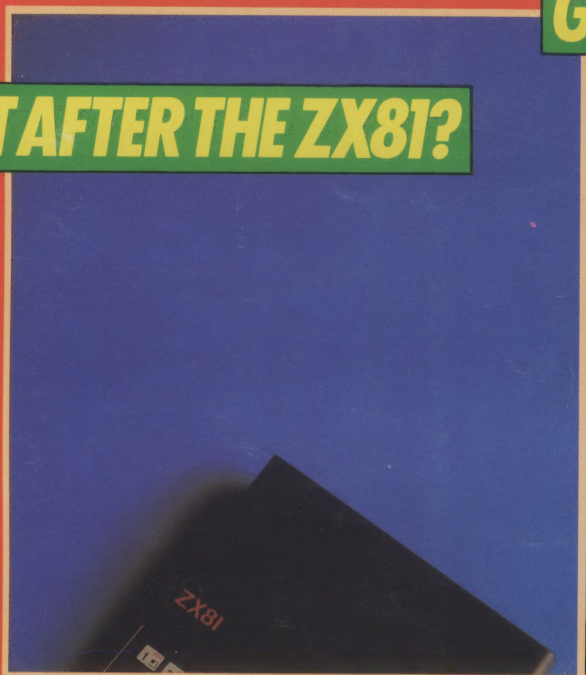
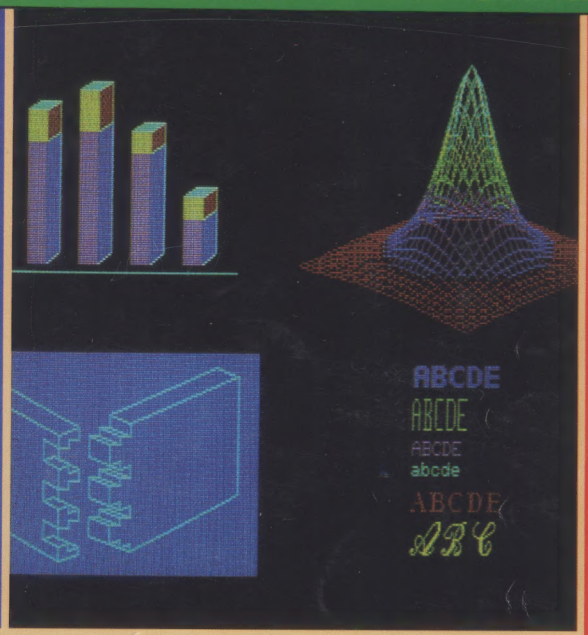
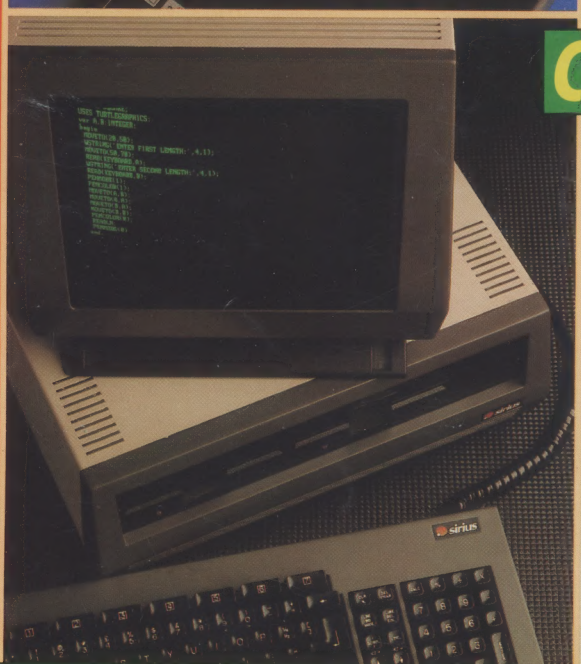
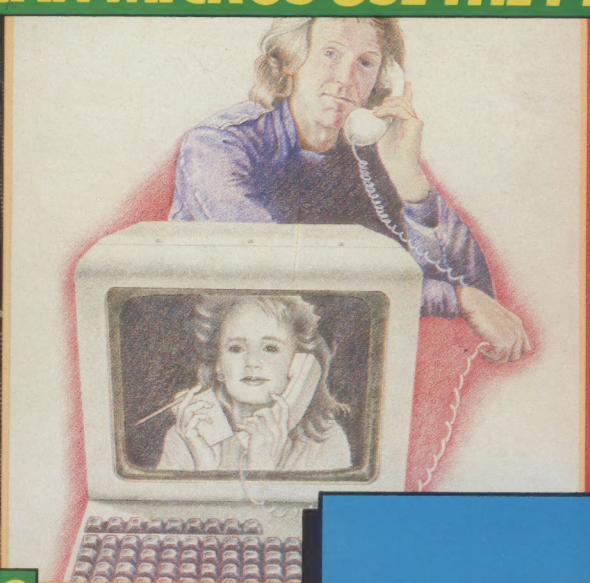




CAN MICROS USE THE PHONE?





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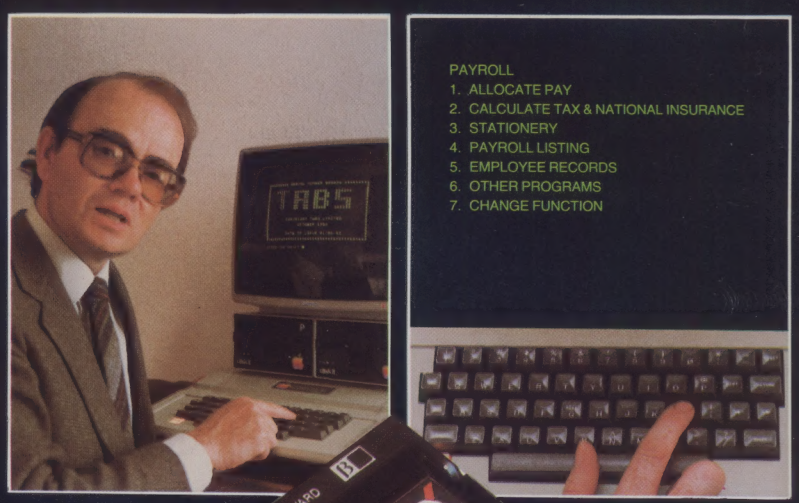

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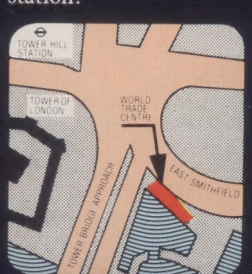

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COMPUTER Answers

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Computer Answers, 62 Oxford Street, London W1A 2HG.
Telephone 01-636 6890.
Issue number 1. November/December 1982

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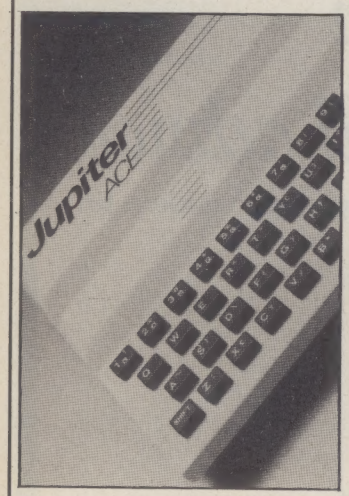

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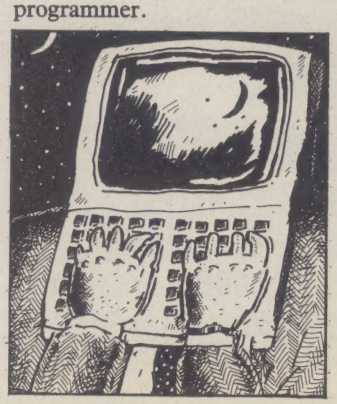

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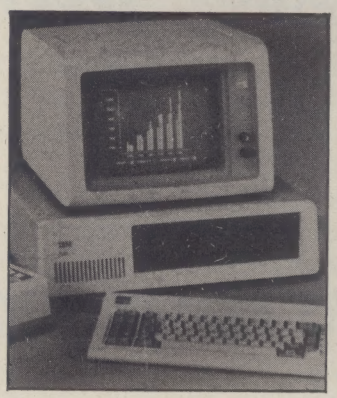

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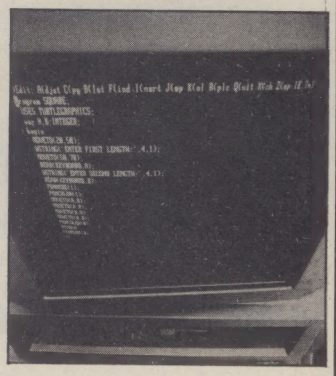

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COUNCIL OF ELDERS

The Council of Elders is a pool of knowledge where micro users can come to drink.

As we thirst for a fuller understanding of micros, so the Elders will provide help and guidance. *Computer Answers* has laid the foundation stones of the Council and has selected seven founder members to guide us on our way.

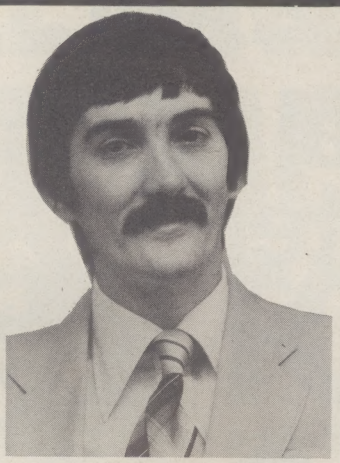
They have been plucked from all areas of microcomputing; hardware, software, programming, communications and education. But they all have one thing in common. It's not advanced age, as the title may suggest. It's experience.

A full council will evolve over the next few months to include experts in other micro subjects.

The Council is administered from the *Computer Answers* editorial offices. When readers have problems with their machines, software or programming techniques, and if experience in the same area will help supply an answer, the appropriate Elder will be contacted by *Computer Answers*.

So be our guest and join us in a drink from our deep pool of knowledge. Let us first introduce our Elders and may you benefit from their combined wisdom.

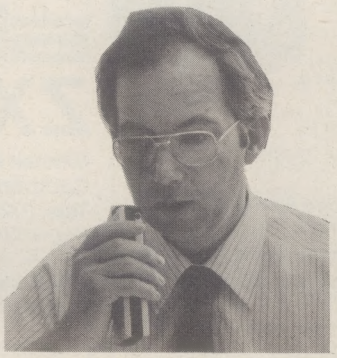
Guy Kewney left university in 1965 to become a computer programmer and entered journalism in 1966. From there he moved to advertising and the airline and travel business before returning to journalism in 1974 to work on *Dataweek*. His next move was to *Electronics Weekly*, where he saw the start of the microprocessor revolution and became the first journalist to build a computer from a kit. In 1977 he moved to *Computing*. While there he became computer consultant for *New Scientist* and later worked on *Personal Computer World*. He became editor of *Datalink*, leaving in March 1982 to work as a freelance journalist.



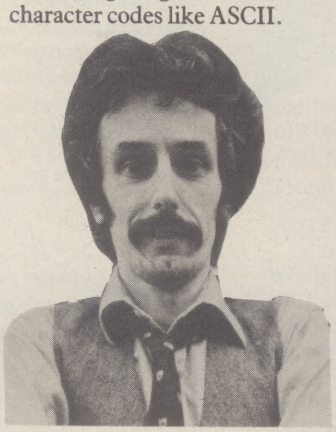
Richard Clark has been involved with computer communications since he left Cambridge University in 1971. He gained much of his experience from that part of the Post Office now known as British Telecom, in the datanetworks division. He worked on the development of services designed to use the telephone network for computer communications, notably Prestel (he worked with Prestel inventor Sam Fedida). He now runs two companies, Jones de Smith, which is involved in communications market research, and software house, Computex. He is also involved with draughting standards for character codes like ASCII.

Julian Allason began his career as a journalist on the *Daily Mail* in the south of France. Two years later in 1970 his interest veered towards electronics and in 1972 he launched the first video tape recorder, made by Philips, in the UK. In 1976 he became interested in micros and in 1978 set up Petsoft. This company sells software for the Pet, and is said to be largely responsible for making the Pet so popular in the UK. He sold Petsoft to ACT in 1979 and became a magazine publisher, although he remained a consultant for ACT. This year he sold his magazine, *Microcomputer Printout*, and is currently involved in projects relating to micros.

Alex D'Agapeyeff became involved with the first experimental computers and was one of the first people to design operating systems and applications software. Over 20 years ago he set up one of the earliest software houses in the UK, CAP. Before leaving CAP he oversaw the birth of its micro division (later to become MPSL) which sells a Cobol compiler. He is now an established consultant on expert systems and fifth generation machines. He is the head of the specialist group on expert systems for the British Computer Society and advises government bodies on computer policy.



John Coll was teaching rock-climbing, canoing and sailing in Wales after he had graduated in physics at the end of the 1960s. He then went to teach less strenuous subjects in Scotland. He taught physics and electronics at Oundle school near Peterborough for seven years and whilst he was there he was chairman of MUSE, Microcomputer Users in Secondary Education, and was also on the government advisory panel for the micro-electronics in schools program. He left Oundle last summer and is now manager of education services at Acorn Computers, the makers of the BBC micro.



Hardware design expert, Derek Rowe claims he appeared from nowhere in 1969 as a consultant. For seven years he advised government agencies on the design of secure communications equipment, mainly for heads of state. In 1976 he entered King's College, Cambridge as an undergraduate reading philosophy. Two years later he set up his own company, Abacus Computers, to import some of the first CP/M systems. He sold Abacus to the Datatype Group in 1980 and is now the managing director and partner of Small Systems Engineering Ltd, a company renowned for its IEEE interfaces for micros.

David Ferris studied philosophy and maths at Nottingham University. In 1974 he crossed the Atlantic to take a PhD in philosophy at Stamford University in California. There he took an interest in computers and switched from his PhD course to a Masters in computer science. In 1976 he joined US software house, Cincom, and helped develop the TIS database system. While working as a salesman, he became interested in micros and in 1979 left Cincom to become an independent consultant based in the homeland of microcomputing, San Francisco, and over here in London.

Sinclair ZX81 Personal Computer

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It's your chance to learn computing...
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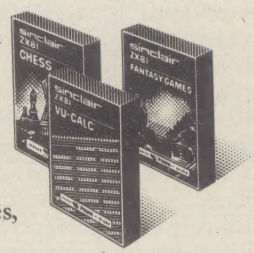
A 212-page BASIC manual is supplied with every ZX81. It makes learning for you and your children interesting and enjoyable. Follow it through and you'll quickly move from first principles to quite complex programs.

Within a week, you'll be writing programs of your own – with confidence!

to choose from a great software range...
The ZX81 is such a popular machine that the range of software programs is growing all the time!



All you need to run many programs is a portable cassette recorder. (Some require a 16K RAM pack.) Connecting leads are supplied.

Over 100 companies, including Sinclair, are currently supplying programmed cassettes for the ZX81.

The Sinclair range, produced by ICL and Psion, is excellent. From challenging games to educational lessons...even business or household management programs!

They give your ZX81 even more scope, and show you computing in action.

to join ZX enthusiasts world-wide...
Long after you buy your ZX81, lively magazines such as the Sinclair User and ZX Computing keep you in touch with any ZX developments. With informative articles, news and reviews, and complete programs – written by other ZX owners.

There are local Sinclair clubs and groups... even special exhibitions purely for Sinclair owners – like the ZX Microfairs.

And schools have taken to the ZX81 as a standard teaching aid. The ZX81 is so easy to use, that learning happens by doing, right from the start.

to have a system you can easily expand...
Your ZX81 is more than just a computer. It's the heart of a computer system. A system that is easily expanded as your skills and needs develop.

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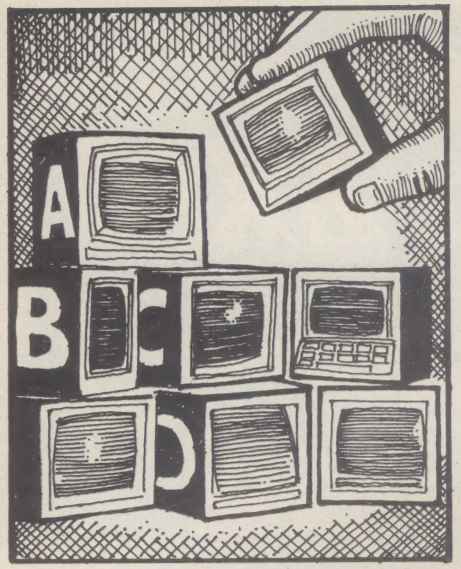


Need some ideas for improving your machine performance? This upgrade section will supply them along with reviews of machines, guidance on new products and technologies. Suggestions for increasing the power and sophistication of your system come thick and fast, so read on if you want to upgrade your ZX81. We look at the Jupiter Ace, the Commodore 64, the DEC Rainbow and the real difference between a 16 and 8-bit micro.

ACE BREAKS THE MOULD WITH FORTH

The Jupiter Ace, with its Sinclair-like price and design, offers a cheap opportunity to get into the language Forth. But is it an opportunity worth taking?

There are many reasons why people buy a cheap micro. It might be to learn programming or to extend programming expertise, it might be to play games, or it might be for 'serious' applications, such as stock control, or regression analysis.

Many parents buy micros for their children to play space invaders. The children and parents become interested in programming; and then the adults start to use the micro for practical things they had not imagined at the outset.

How does the Ace fit into this scheme, as a cheap micro?

The answer is that it does not fit easily into any scheme—it is a very different machine. Given the present state of the micro market, the Ace has two big question marks: one, it is not a colour computer and two, it does not use a variant of the common language Basic but uses instead a language called Forth.

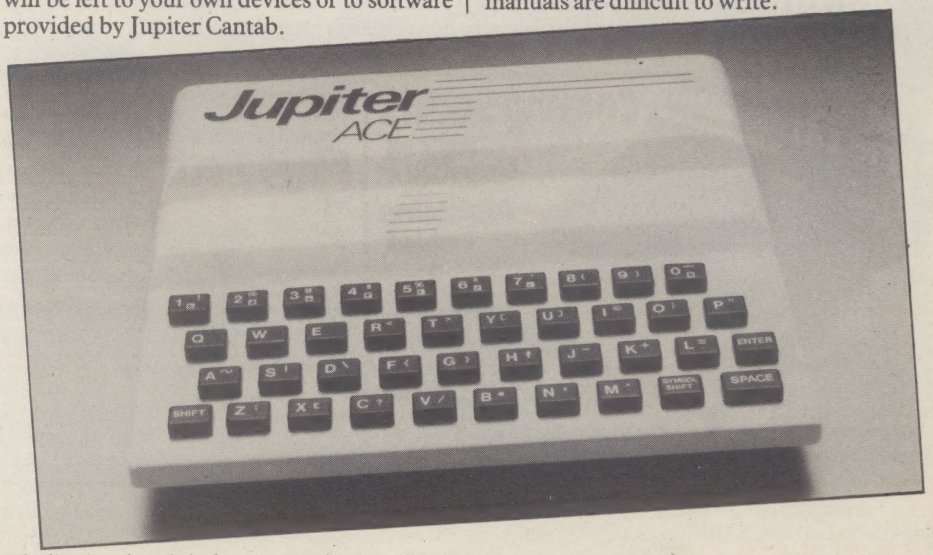
If you want to buy a computer to play games, and that is all your are really interested in, this is *not* your machine. Forth is completely different to Basic. It has been principally used for 'serious' applications. This means that there are no listings of Forth computer games which one can conveniently copy. The Ace is unlikely to have many suppliers of software for some time, so you will be left to your own devices or to software provided by Jupiter Cantab.

Jupiter Cantab means Richard Altwasser and Steven Vickers, (designers of the Sinclair Spectrum). The software for the Spectrum produced by Altwasser is very expensive and not very good (I refer to the *Cambridge Colour Collection*).

In an attempt to get Forth users to buy the Ace, and write software for it, there's a special deal for members of the Forth Interest Group (FIG). If a FIG member buys an Ace, he or she will be entitled to a £5 reduction on the following year's membership fee.

When we come to those who want to buy an Ace to learn to program, the language is Forth, and though there is nothing wrong with Forth – in fact it has much to offer – help is not so plentiful. So far there is only one book which attempts to introduce Forth (most books assume some knowledge), and that is *Starting Forth* by Leo Brodie; and so the novice (or not so novice) who wishes to program will have to depend on the manual provided with the Ace.

Most manuals to accompany Forth on other micros are either incomprehensible, or insubstantial, and Brodie's book takes about 350 pages to only go a small way. For Forth, on a micro which *cannot* run Basic, the manual is extremely important, and good manuals are difficult to write.



The Jupiter Ace: is it the way Forth?

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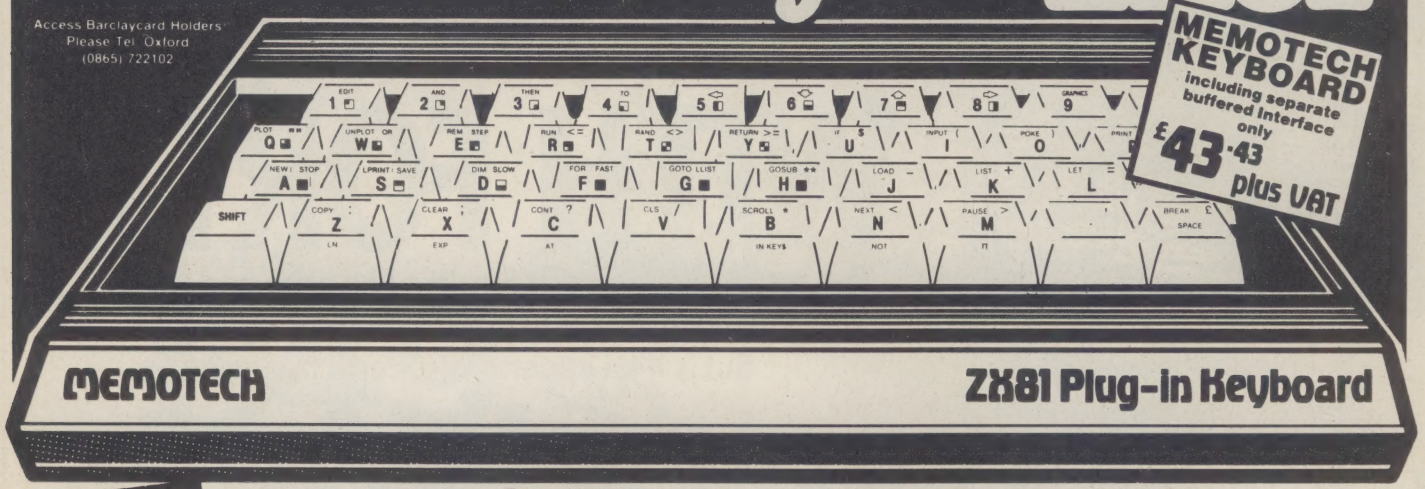

NEW Memotech's Plug-in ZX81 Keyboard

- Plugs directly into the back of your ZX81
- Keys have durable Sinclair legends
- High quality typewriter keys
- Does not inhibit other add-ons
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- Complete with buffered interface
- Fast and easy data entry
- Moveable between configurations

Memotech's Memopak Range

Current Memopaks
16K
32K
64K
HRG
Centronics Interface

MEMOPAK 64K MEMORY EXTENSION

The 64K Memopak extends the memory of the ZX81 by 56K, and with the ZX81 gives 64K, which is neither switched nor paged and is directly addressable. The unit is user transparent and accepts commands such as 10 DIM A(9000).
Breakdown of memory areas...0-8K Sinclair ROM. 8-16K This area can be used to hold machine code for communication between programmes or peripherals. 16-64K A straight 48K for normal Basic use.

MEMOPAK 32K and 16K MEMORY EXTENSIONS

These two packs extend and complete the Memotech RAM range (for the time being!) A notable feature of the 32K pack is that it will run in tandem with the Sinclair 16K memory extension to give 48K RAM total.

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Main Features — • Interfaces ZX8I and parallel printers of the Centronics type • Enables use of a range of dot matrix and daisy wheel printers with ZX8I • Compatible with ZX8I Basic, prints from LLIST, LPRINT and COPY • Contains firmware to convert ZX8I characters to ASCII code • Gives lower-case characters from ZX8I inverse character set

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Once the purchaser of the £90 Ace has learnt to program in Forth, then the Ace can be used for serious purposes (including writing games software). The graphics capabilities of the Ace are fair, though not in colour, and the user-defined graphics are simple to use (once one knows how to program in Forth). The special version of Forth developed for the Ace is very easy to use, as Forth goes.

The cassette operating system is simple to use and has many affinities to that for the Spectrum, and the whole Ace Forth environment is very stable—something not true of most other Forth systems on micros. A game written for the Ace might run more quickly than that on another micro programmed in Basic; but machine code is swifter still, and the Ace program will be in black and white only.

Forth is a *very* different language. It was designed for control applications such as pointing telescopes in the right direction, or operating robots—it is designed to produce exceedingly fast-running programs. This, therefore, is one serious application for which the Ace should be best suited.

To run a robot, or a model, requires the Ace to talk to the robot via some communication device, but the Ace, unfortunately, only has ZX81/ZXSpectrum style of hole in the back where you can plug things in—it is not a standard interface that you might use for control applications. The keyboard on the Ace looks remarkably like that of the Spectrum, and the machine as a whole gives the impression of being a ZX machine—not substantial enough to use in a dusty factory.

The Ace might find use as a demonstration machine to show how one might use a Forth computer to control applications—but that is possible with the BBC computer—or the Ace might be used for the two examples given at the beginning, stock control or regression analysis.

For stock control the Ace is not suited, because the speed of Forth is not essential—the speed at which data can be accessed off the storage medium is far more important—given that this is the case, there are many machines (eg the Spectrum) for which the programs are easier to obtain.

In regression analysis the key problem is the accuracy with which the fractional numbers can be stored. Ace Forth does have fractional (or 'floating-point') numbers but they are of limited accuracy (only six digits)—even the ZX81 is more accurate.

The memory available on the Ace is rather limited, though it is possible to use the Sinclair 16K RAM Pack, and so the Ace can only tackle medium-sized problems. For those who would like to see a line of Forth, the Forth words to emulate the Basic command X = X + Y are X @ Y @ + X! You can see why the usual cacophony of books originally written for the ZX80, and changed for each new computer, will not appear—and how dependent one is on the manual and software from Jupiter Cantab.

*Further reading: Starting Forth by Brodie, Threaded Interpretive Languages by Loeliger.
*Forth Interest Group, c/o 38 Worsley Road, Frimley, Surrey GU16 5AU.

UPGRADE

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The Rainbow combines an 8-bit micro with a 16-bit. Is this two machines for the price of one?

The Rainbow is a new 16-bit micro with a split personality; it has two microprocessors, a 16-bit and an 8-bit. This Digital Equipment machine shows the present lack of conviction in the 16-bit market. A market where software is still thin on the ground.

But it does make the Rainbow attractive to users who want, and are prepared to pay for, a micro that can run both 16 and 8-bit software.

It is worth looking at the 16-bit market to see where Digital Equipment Corporation (DEC) fits in.

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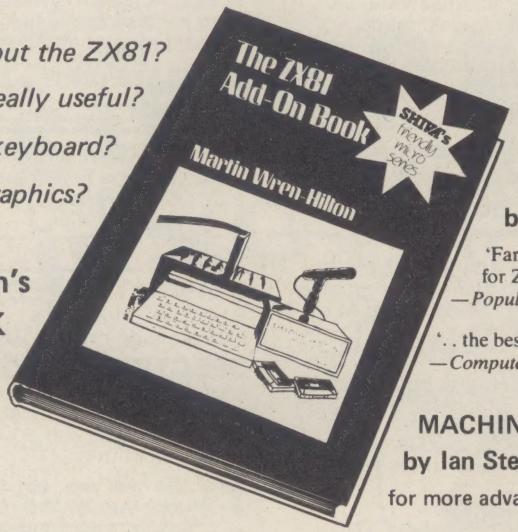

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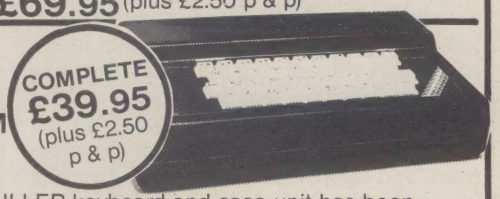

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Now, Digital has produced three micros. For the first time DEC has followed, rather than led, IBM in technology or marketing. Or has it?

The three DEC machines will probably be on sale in January. The most significant of the trio is the Rainbow, because it is a traditional micro. It even uses CP/M.

The main difference between it and most CP/M machines is that it's a 16-bit design, like the IBM and Sirius computers. At least, that is the most obvious difference.

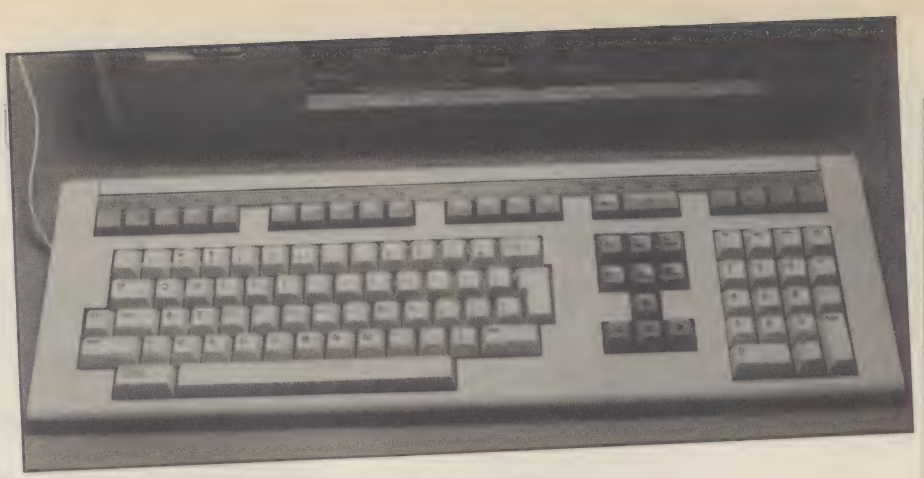
More significantly, it doesn't use the standard CP/M, but a new operating system called CP/M-80-86, written by Digital.

This system is supposed to be the same as CP/M and CP/M 86 combined because the machine uses both the 8-bit Zilog Z80 and the 16-bit Intel 8088 as its central processor chips.

As if by magic, or so it might seem to most users, the machine can detect whether a program on a diskette is written for the Zilog or the Intel chip, and will use the correct processor to run it.

It was not possible to test the machine before press-time, since few models are available. However, there is nothing startling about its processing speed, judging by brief tests at an exhibition on a sample with very incomplete system software.

Processing speed is influenced by many factors; the speed of the processor is only a small contributor. The sophistication of the code which reads data off disks, and writes it onto them, is more important, and the method used to display text on the screen is what makes so many CP/M machines slow.



The keyboard of the DEC Rainbow – a sophisticated machine.

Normal CP/M takes each character to be displayed, and puts it through a complex program routine, which ultimately puts the character in the memory at the point where it will automatically be displayed.

But inbetween moving it from one section of memory to another, it goes through a formal pretence that it is sending the character to a remote printer. The result is that it can take several seconds to fill a screen with text, even though it could be done in less than a hundredth of a second.

However, DEC has 'improved' CP/M to prevent it taking over control at embarrassing moments, and to make its error messages more useful.

Generally, when a Rainbow finds a disk problem that would 'crash' an ordinary CP/M system, it advises the user how to recover.

Without detailed analysis of the machine code of the Basic Input Output System (BIOS), it isn't possible to know what extra 'go-faster' facilities are available to the programmer, apart from the normal CP/M utilities.

Unfortunately, DEC is more interestd in its other 16-bit micro, the Professional, which is based on its minicomputer range. Experts on the new CP/M system are not easy to find, and won't be for a few months.

But if anybody can get away with 'restructuring' CP/M, it must be Digital. Unlike other minicomputer makers, DEC can boast a great many users, with experience of its equipment, who would regard its software as a standard.

The Professional could start a new 16-bit standard which is more attractive to the average user. The Rainbow, may sell because of its relationship to the Professional, and because of its unique CP/M features combining access to 16-bit and 8-bit software.

Priced between £2,200 and £3,000, the Rainbow and its cousins look like becoming significant machines to the micro world.

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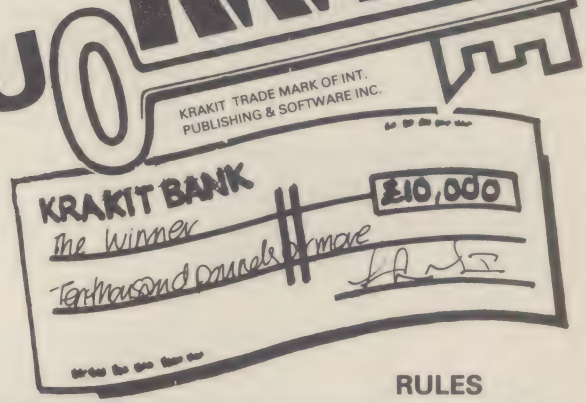

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VIC GETS THE PET'S POWER

The Commodore 64 is packed with memory and features. Is it a Vic upgrade, or an alternative to the ageing Pet?

The Commodore 64 looks like the popular VIC 20, with a couple of extra holes on the side, and a smaller one at the back.

It is a powerful micro with a full 64 Kbytes of memory—as much as can usefully be plugged into a standard 8-bit microprocessor. Inside, it uses a slightly enhanced version of a standard 6502, as used in Atari, Acorn, Apple and Commodore machines.

Although it has nothing innovative, it includes a full set of features in place of the one found on other machines. For example, it has powerful graphics, capable of animated moving characters of a cartoon style, like the Texas; it includes sophisticated sound synthesis, like the Atari; it has a method of switching memory banks to expand its power; and is unusually helpful to writers of machine code programs. It looks, in fact, very like the BBC micro without BBC Basic—and even that may be rectified.

Commodore is like Apple in many ways; it earns its living by selling improved versions of the original Pet from a basic design which is getting outmoded.

Both machines have adapted badly to life in a world of disks, but apart from that, the original designs are still impressive, because competitors have not really challenged them.

The Commodore 64 is an attempt to extend the life of the original Pet. Anybody who has used a Pet, can use it. They will recognise its Basic commands, will understand its graphics symbols, and will very quickly learn the one or two tricks needed to write commercial software for it.

But all that could be said about the original VIC 20. Why do it all again? The answer is: Commodore got it wrong with the VIC. It was too vulnerable. The VIC was a cheap computer, in a world which wasn't expecting things like the Sinclair Spectrum, or the Oric, or the Dragon. Cheap, when VIC was designed, meant around £200.

Arguably, the Spectrum is not as well packaged as the VIC—but if it came to a fight, it would win because it could suffer a 50% price cut and still make money.

By producing the Commodore 64, costing just under £300, with its extra memory, ability to use text (readable text, not the enormous fat VIC letters) and very clever graphics, the company has produced a machine which costs almost exactly the same to produce as the VIC, but is capable of competing on performance with machines far more powerful than the Spectrum.

Commodore could do nasty things to the Spectrum, with the new machine. Even now, it stands up well against the BBC micro, which is currently the standard by which machines under £500 are judged.

Popular machines were designed for home use, on the assumption that people don't work at home. They play.

The Apple II design is a classic as a games micro. Texas Instruments has a machine to play educational games. Atari has two machines; the Atari 400, designed mainly to play games and the Atari 800, designed for serious computing, and to play the Atari games.

The VIC 20 can play games and, theoretically, be turned into a working machine by somebody too short-sighted to see how much extra they would have to buy before it was up to the job.

The BBC micro was the first machine under £500 based on the assumption that people would want to work with the machine, not just play. It has advanced graphics – it can use multiple colours fast, in ways as useful to somebody designing a chip or displaying business figures, as to the Space Invader hunter.

The sprites (programmed shapes) on the 64 are one step better than printed characters which the user can define—they are much bigger, and much more moveable.

Each sprite is 24 dots across and 21 dots tall. The user can move the entire shape around the graphics display by telling it the coordinates to move to in Basic.

And since the coordinates can be Basic variables, they can move in complex patterns. Nobody would want the 64 different designs on the screen at once, but you might want to use eight of them to simulate rotation.

The sprites themselves can't spin, but if the program replaced an upright picture of a pole with one at an angle, it would appear to topple.

The big attraction of the sprites is that they can recognise when they are displayed in the same place on the screen and interrupt the program to say so.

The 64 is a Pet. It would be possible to connect Pet disks, a Pet printer, and a green monitor, and pretend you were using the 4030 series Commodore machine.

The main difference is that you can load programs by plugging in cartridges at the back. Most of the available cartridges are for games. A plug-in Basic, Simons Basic, provides the sort of structured language that users of Comal and BBC Basic will recognise. Like BBC Basic in high resolution mode, it leaves little spare memory in the 64 Kbytes—only about 13 Kbytes for user programs. And it costs extra (probably around £50).

The unique thing about it is the full 64 Kbytes of user memory, not just enough to fill the gaps left beyond the read-only memory (ROM). No matter what ROM is used—plug-in cartridge, Basic, machine operating system, or whatever, there is always read and write memory at the same address.

The ROM can be switched off by the central processor. It has a built-in device for input and output, which is used to direct commands to the memory map, turning on sections of ROM, to suit whatever software is run. The main advantage of this is that program development can be done in user memory, at the same machine addresses it would use if it were in permanent memory. Normally, a software developer would have to develop his or her program on a different machine, and down load it (or develop it at a different series of addresses, and then 'relocate' it, which is always risky).

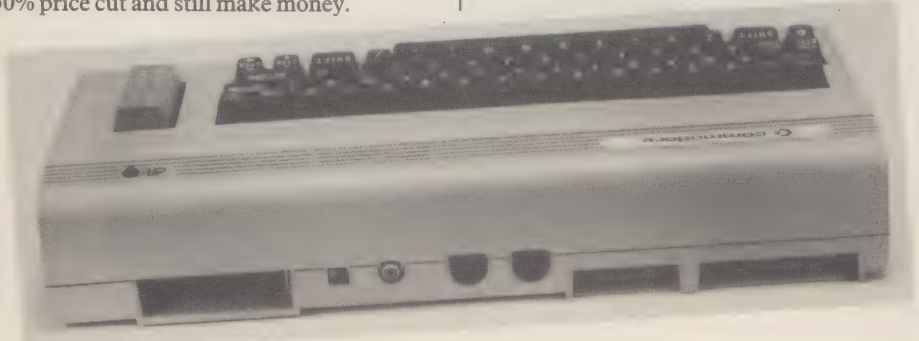
There are few other surprises. There is a single disk drive, no dual drive (although four single drives can be attached, at £300 each) and an optional 'universal bus' (the IEEE 488) to drive normal Pet peripherals. And the machine can cope with joysticks for games.

There will be software for this machine, and if it had been launched a year ago, it would have swiftly dominated this market. But the special video interface chip (VIC) and sound interface device (SID) were not ready and in the meantime the BBC micro has flooded the market.

The future of Commodore in this market lies with its new designs, the 500 and 700 series, and with the best will in the world, the 64 is merely the last blow of the original Pet.

But it is a very good last blow, and is capable of running for two years if marketed aggressively. It can undercut the BBC and the Atari on price. It outperforms things like the Tandy Colour and Texas Home Computer by a wide margin, and because so many people understand the Pet design, it will attract a lot of software quickly.

And it is still capable of expansion, because Commodore has the 8096 Pet which has 96 Kbytes of memory.



The 64 is like a Pet, except you can plug in cartridges at the back

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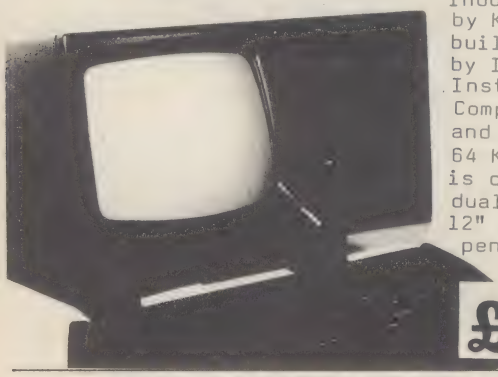

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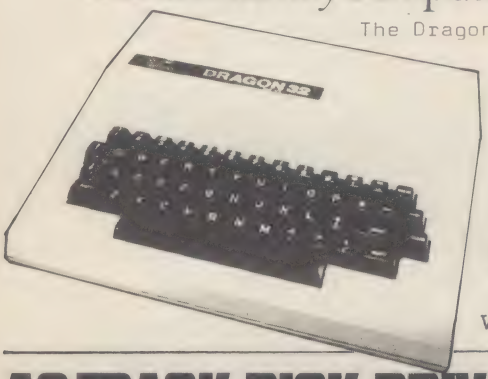

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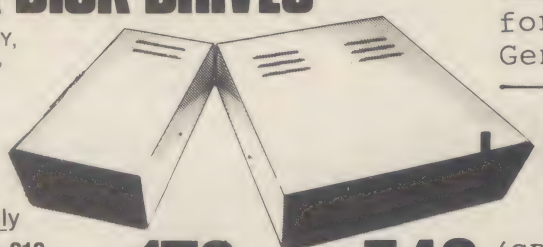

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Q&A

ADDING TO THE ZX81

I am the proud owner of a Sinclair ZX81. Like, I imagine, many others I'm wondering where I go from here. My ZX81 only has 1K of memory, which means I can't run a lot of games programs. I would also like to have access to some colour games.

There will come a time when most of the 300,000 or so ZX80 and 81 users will wonder where they should go next. There can be little doubt that most users will eventually want to try out facilities offered by more expensive machines.

Where to go from the ZX micros depends on what you want to do.

A visit to the ZX Microfair in central London will tell you that there's a lot you can do with the ZX81 itself. A vast range of peripherals, add-ons and software have been developed. For example, if limited memory capacity is a problem, you can buy Clive Sinclair's own 16K RAM pack, or one from an independent supplier. Companies (for example Memotech) offer 64K RAM packs, the amount of memory usually found on much more expensive machines.

If you're getting bored with the touch insensitive keyboard, you can invest anything between £10 and £40 on a electric typewriter-type keyboard.

Examples of what you can buy include a keyboard plus case from Fuller of Liverpool for £39.95, and keyboards of varying sophistication (for example, some include a repeat key, or two shift keys) from Harris and Lockyer of Redditch, Worcestershire (£25), Maplin of Rayleigh, Essex (£19.95) and David Heartford of Evesham, Worcestershire (£11.95).

If you want to connect the ZX to a proper printer, rather than the one supplied by Sinclair, which uses special silver-coloured paper, you can buy special adaptors.

You can buy new cases, new circuits, new automatic tape controllers, new anything.

These available extras are often packed together. For example, a company called Data-assette of London produces an add-on, which provides a standard RS232 printer connection and an automatic tape controller to connect one ZX81 to up to four cassette tapes. The system costs just under £60.

The ZX80 and ZX81 market is so vast it is impossible to list every supplier. Useful information on what's available can be gleaned from one of the user groups, or by asking the suppliers themselves.

You can even connect a ZX81 to a hard disk drive, which can store millions of characters of information. For those yearning for colour, one company offers colour graphics facilities for about £40.

One example of the ZX81's expandability comes from a company called Basicare. The company has adopted the concept of the 'organic micro', meaning you can build up the power of the ZX81 using a series of modules. Using this approach, you can have 64 Kbytes of RAM, with facilities for connecting just about any peripheral you care to mention.

The advantages of taking the add-on approach when upgrading your ZX81 is that it's cheap (if you choose carefully) and has an ecological virtue in preventing you throwing away perfectly good hardware and software.

Unfortunately, you can end up with a system that comes from 20 different suppliers. If something goes wrong, you are faced with the problem of finding the faulty add-on, and then trying to wring some support from the supplier. Whichever way you look at it, support for the ZX81, the services you need to maintain and update it, is a problem. Cheap support tends to come with cheap machines. In some cases no support. If you choose to buy add-ons, always try to get the supplier to provide you with some written assurance that you will get some help if and when you need it.

You may choose to sell/chuck/give away your old ZX81 and buy something new. The replacement machine you choose depends on your budget and your reasons for abandoning the ZX81.

If you want some colour the Spectrum may be a good choice. It's cheap, and like the ZX81, there will be a large choice of software and hardware add-ons available from independent suppliers. It will also link in with Sinclair's super-cheap microdrives, which offer mass storage and much faster access to the data and programs stored than with a cassette.

Sinclair has also promised an RS232 interface, which you can link with many different types of printer and devices that allow you to talk to other computers.

One thing you can't do with the Spectrum is run all the ZX81 programs on tapes you've bought, though the Basic programming language versions used by each machine are roughly similar. If you bought an Acorn Atom, or a BBC Microcomputer (both being built by Acorn of Cambridge), you will find that they use a different version of Basic to that used on the ZX machines. You will have to learn a few new commands and facilities, which shouldn't be much trouble if you know Basic well.

Other machines under £500 include the Tangerine Microtan (under £70), the Commodore Vic (starting at £180), the Texas Instruments TI 99/4A (about £200), the Atari 400 (about £300) and the Tandy TRS-80 Colour (about £450). All these machines offer colour graphics as standard or optional, but beware of equating high price with extra graphics facilities. For example, the Osborne 1 portable micro with disks costs about £1,200 but has no graphics facilities worth mentioning.

One way to decide on a new machine is to consider how you're going to use it, which means finding out what software you want. This is probably the most sensible way. For example, if you are tired of your 1K ZX81 because what you really want play is Adventure, which doesn't need colour graphics being a text-based game, you needn't shell out on a new colour machine. Instead you could buy a 16K RAM pack.

You're in an enviable position: a whole world of extra add-on fun-facilities beckons you.

✻Microfair, 71 Park Lane, Tottenham, London N17. Telephone: 01-801 9172.
✻National ZX80/81 User Club, 44-46 Earls Court Road, London W8.
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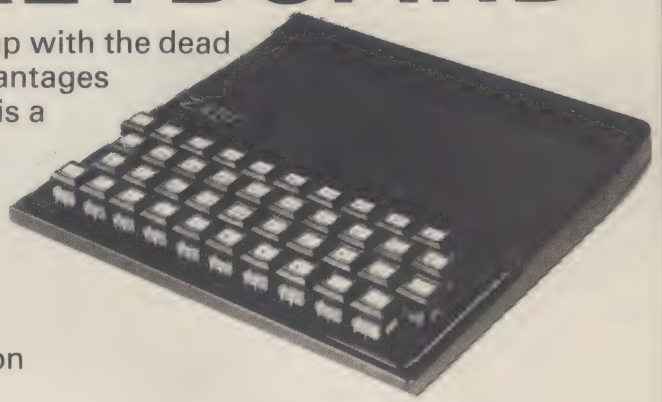

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Q&A

DOES TWICE THE SIZE MEAN TWICE THE POWER?

When owners of 8-bit machines, like the Pet, Apple and Osborne, decide to move up to 16-bits, what are they getting twice as much of?

With the emergence of 16-bit micros, like the IBM Personal Computer, the Sirius and the Digital Equipment (DEC) Rainbow, the industry has become bit obsessed.

The 16-bitters (people who sell 16-bit machines) say that their products are now cheap enough to compete with 8-bit machines but offer much more power. The 8-bitters contest that only a few people need the extra power, that 8-bit machines are still considerably cheaper and offer a much wider range of software.

At the centre of the argument lies the microprocessor chip, the thing that, given the software, does the work. It is told what to do, and makes all the calculations using binary digits – bits. Similarly, the machine's memory stores all the data in the form of binary digits.

The long and short of it is that an 8-bit processor can cope with an 8 digit binary number all in one go (it is treated as a single 'word'), whereas a 16-bit processor can cope with a 16 digit binary number. So, to this extent at least, a 16-bit processor is more powerful. It can calculate twice as much internally.

This does not necessarily mean that a 16-bit processor is twice as fast as an 8-bit. Another factor that enters into the calculation is the clock speed. A clock is connected to the processor to check the speed of calculations. Clock speeds are measured in megahertz (Mhz), and many 8-bit processors run at about 2Mhz, some at 4Mhz. The 16-bit processors used in the Sirius and IBM PC run at 5Mhz. So, in principle at least, a 16-bit 5Mhz processor can calculate five times faster than an 8-bit 2Mhz processor. But this is only as long as you think of the processor as an isolated chip, and ignore the business of giving it instructions and taking in and pushing out data.

A processor has a motorway

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Q&A

that carries all the incoming and outgoing traffic, both instructions that tell the processor what to do and the data it processes. This motorway is multi-lane, but only single carriageway, so at any one time the traffic is travelling in one direction only.

The motorway is known technically as the data bus, and the number of lanes it has depends on which processor chip is used. If it is made by the American company, Intel, and imaginatively called the 8088, it has eight lanes.

Another Intel chip, the 8086, has a 16 lane data bus. If you imagine each vehicle on the motorway as one binary digit (one bit), then the 16 lane highway can take in or push out a 16 bit number all at once, as a single word.

Both the 8088 and the 8086 are 16-bit processor chips. The 8088, currently the most popular 16-bit chip, is used in the IBM Personal Computer and the Sirius. As its motorway has eight lanes, it is described as having an 8-bit data bus. This means that the numbers it processes have to come in two parts.

A microprocessor has one other bus, called the address bus. All the traffic that goes up and down the databus motorway is parked at various places in the computer's memory. Each parking space has an individual address, so that the processor knows where it has put the data it needs.

The maximum number of parking spaces available depends on the number of individual addresses the processor can use. On most 8-bit processors, the address bus is described as being 16 bits wide, which means it addresses each parking space (or location, to use the proper term) with a binary number 16 digits long. A quick calculation will tell you there are 65,536 different combinations of 16 binary digits.

Since every location in memory has to have a unique address, this means a microcomputer with an 8-bit processor (which has a 16-bit address bus) is limited to a memory with 65,536 locations (known as 64 Kbytes, for certain occult reasons). A 16-bit processor like the 8088 has a 20-bit address bus, which means you are limited to 1,048,576 memory locations (known as one megabyte).

So another advantage of a 16-bit processor is that it can usually use much more memory.

The instructions a processor uses come in the form of 8-bit or 16-bit words, depending on the type of processor. The 16-bit processor can use instructions that are 16 bits long, which means they can contain more information than those used by 8-bit chips.

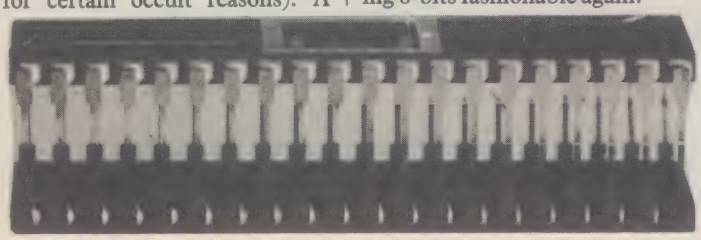
But the power of the 16-bit chips is limited. It is, to use a graphic example of the technology lingo, 'I/O bound'. This means that the chip has to slow itself down to cope with all the stuff that comes in and goes out through a limited number of outlets. These outlets are the pins that stick out of the chip's black body, and there are 40 in all on the 8088 and 8086.

Some of the pins have to perform more than one function, which limits the speed to what's coming in and going out of the chip.

Despite this, there's little doubt that a 16-bit chip is more powerful than an 8-bit one. But the consideration about whether to upgrade to 16-bit by buying something like a Sirius does not stop there. You may not need all that extra memory or power, you may need better software. There's still far more software available to run under 8-bit machines than for 16-bit ones.

A measure of the potential of the 16-bit chip comes from one of the big US chip makers, Zilog.

Zilog is developing a chip called the Z800, which slots between its super-successful 8-bit Z80, (which runs the CP/M operating system) and the less successful 16-bit Z8000. The Z800 is a fast extra powerful 8-bit processor. And why not 16-bit? Because of the price of circuitry needed to support 16-bit and because there's plenty of power to be exploited in 8-bits. The Z800 should start appearing inside machines next year, making 8-bits fashionable again.



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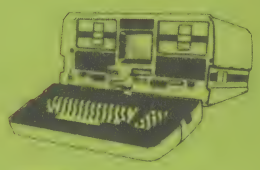

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PLUG INTO NEW SOFT OPTIONS

I would like to use the CP/M operating system on my micro, but I don't have the right processor. What do the different Z80 cards do? Which micros do they plug into and how can I use them?

A huge number of Apples have undergone major surgery over the past few years. They have been subject to mass heart transplants. The new hearts are called the Z80, which is a microprocessor chip. It replaces the Apple's own standard 6502 processor.

This has been done by Apple dealers and owners alike to turn the Apple into a different micro. The type of software a micro runs depends on the processor it uses. So, a program written for a 6502-based machine is very difficult to convert to run on a Z80 machine.

There's a particular piece of software that won't run on the Apple because of its 6502: it's called CP/M. CP/M is an operating system, which means it is a piece of software designed to administer the micro: keep everything in the memory in order, control the disks and the screen. It also comes between the machine and the applications software you want to run on it, which makes it easy to take a program off one CP/M machine and put it onto another.

CP/M will run only on a selection of processors, including the ever-popular Z80. It has become the most widely used operating system for Z80 machines with floppy disk drives.

Users of the popular 6502 machines, of the Pets and Apples, were left out in the cold because they couldn't share in the burgeoning amount of applications software, and in using the successful packages like Wordstar and Visicalc. The company to come to their rescue was the large American software house, Microsoft, which offers a large range of software packages to run under CP/M.

Microsoft realised that there was a huge user base, which wasn't able to buy its CP/M products. So it developed an add-on called the Softcard. The Softcard is a printed circuit board which plugs into one of the slots inside the Apple. It features its own Z80 processor, and comes with a floppy disk containing the CP/M operating system.

When you plug in the Softcard, the Apple essentially turns into a Z80 machine, able to run CP/M and any CP/M software available on disks which use the Apple format.

The 6502 chip is still used, but only for a few of the input/output operations. The main work is done by the Z80.

Since its introduction, the Softcard has given the Apple a new lease of life. Now Apple users form one of the biggest groups in the CP/M users' community. Many dealers sell their Apples with a Softcard included, and many software houses offer their CP/M software range on Apple disks.

Pet users are now beginning to feel similar benefits. Two of the best known means for Pet users to get into CP/M are called CP/Maker and Soft Box.

CP/Maker, like the Softcard, is a plug-in printed circuit board. But there the resemblance ends.

As well as having a Z80, it also has a 6502, which replaces the one in the Pet. On top of this, you get 64 Kbytes of memory, which takes over from the Pet's on-board memory.

Unlike both the Softcard and the CP/Maker, the Soft Box – which comes from Small Systems Engineering – is a separate unit which plugs into the Pet via the external IEEE 488 socket, normally used to connect to the Pet's disks. The disks then connect into the Soft Box. The Pet's 6502 still performs a few functions, but in effect, only those that are needed to keep an eye on what's being entered into the keyboard.

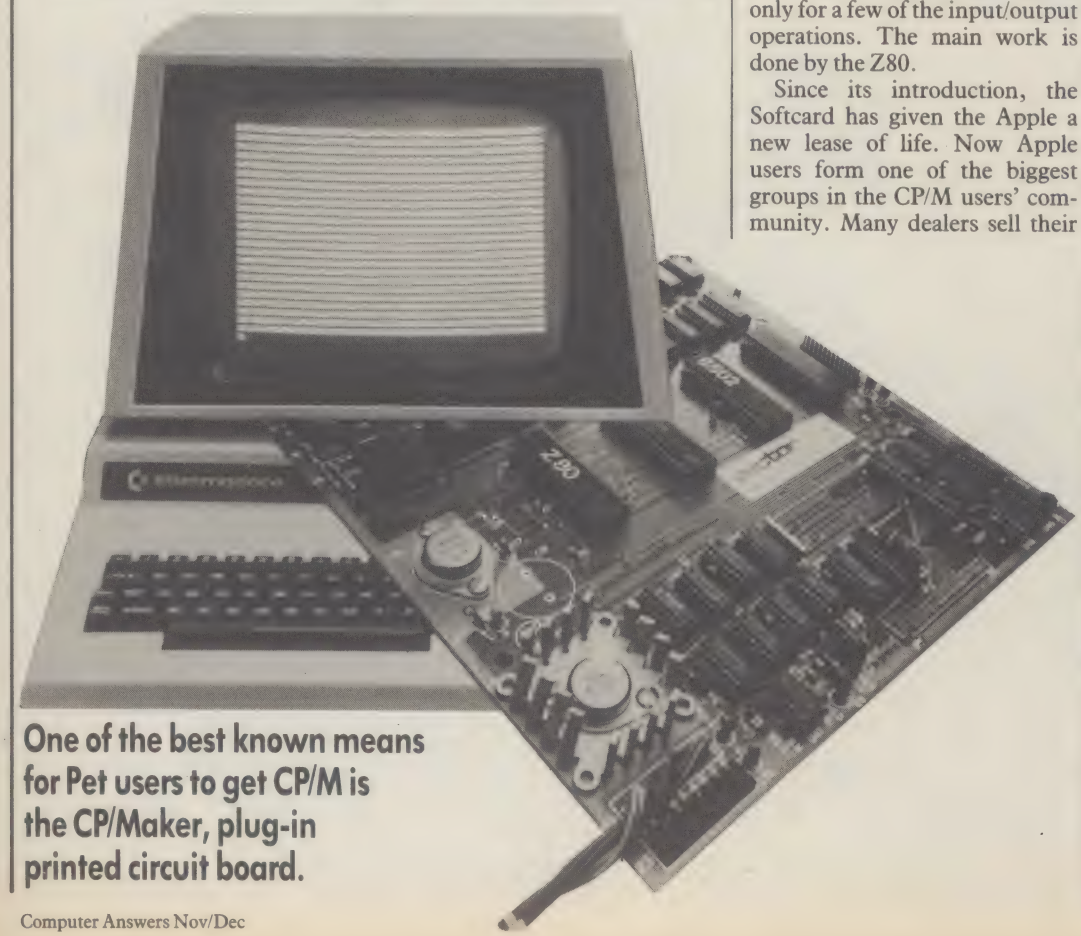
The Soft Box comes with its own 64 Kbytes of memory, and also offers an RS232 port as standard, which can be used to connect to its printers or to communication equipment.

The two Pet Z80 add-ons are pretty pricey, as they come with all that memory as well as the processors. The Soft Box costs £495, the CP/Maker £485.

The Apple Softcard is a lot cheaper at £199. On an Apple with 64 Kbytes of on-board memory, the Softcard leaves you with 56 Kbytes for your own use, the rest being used by the operating software. One other point to watch, at least with the Softcard, is that when running CP/M the Apple is noticeably slower than many Z80-based microcomputers running CP/M.

One indication of the trouble people are prepared to go through to get at CP/M software involves Small Systems Engineering (SSE) and the Sirius micro. One of the big things about the Sirius is its powerful and super-fast 16-bit processor. So what do Sirius owners do? They buy a Z80 card off SSE and plug it into their Sirius, thus replacing the stallion 16-bit processor with that worthy workhorse, the Z80.

All this is done to get CP/M 8-bit applications software to run on the Sirius.



One of the best known means for Pet users to get CP/M is the CP/Maker, plug-in printed circuit board.

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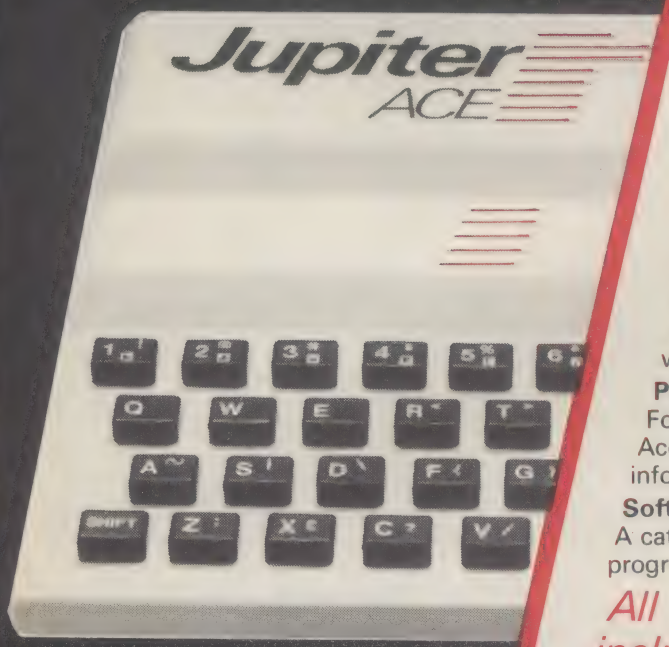

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Technical Information

Hardware
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3K bytes RAM

Keyboard 40 Moving-key keyboard with auto repeat on every key and Caps Lock.

Screen Memory mapped 32 column x 24 line flicker-free display with upper and lower case ascii character set.

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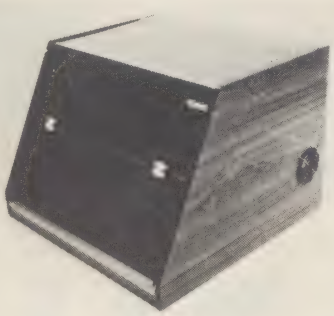

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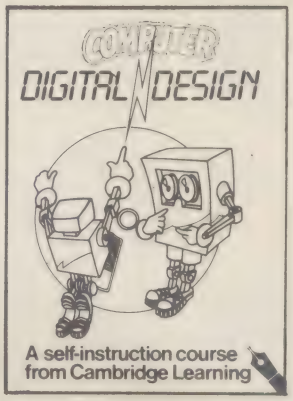

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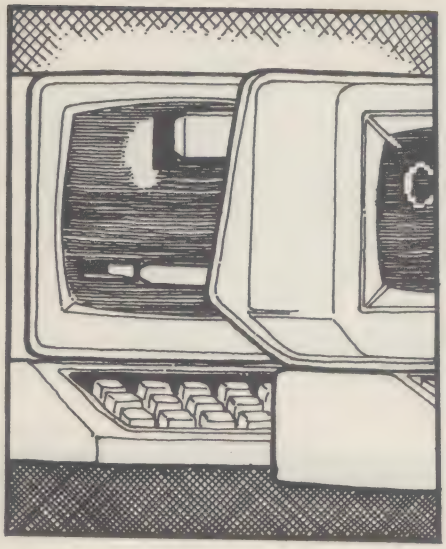


The Connections section is about breaking and entering your micro, and then getting your valuable hoard out. Interfacing equipment, program portability, codes and protocols all involve methods of making connections. In this issue we look at the general concept of input/output, and some of the specifics, like how to connect up to a printer.

LET'S TALK!

'Evil communications corrupt good manners,' *Corinthians (15.33)*

The quote above shows that corrupt data communications were causing concern long before computers were a gleam in Charles Babbage's eye.

Now, here we are in Information Technology year, in the era of the microchip revolution, and how far have we come? As Gilbert (or was it Sullivan?) said: 'But they couldn't chat together – they had not been introduced.'

You've got a micro, I've got a micro, but the chances are at the moment that we can't even exchange an intelligible floppy disk, let alone string a wire between them so I can read your files and you can use my printer.

Imagine if computers had been developed by cool, rational scientists and engineers, dedicated to the well-being of mankind and the pursuit of human happiness.

Just imagine if they had had the benefit of my hindsight, and life were the very pink of perfection: my Superbrain and your supercomputer could talk to each other. I could access your multi-mega disk store and you could leave rude messages on my VDU. You could run my programs under your operating system (and vice versa). Unfortunately, there is a slight snag: deep down inside,

To exchange files between micros you need a code that is common to both. ASCII is often the code that's used, but how does it work? How and where should it be used and when was it developed?

computers use different languages, not only different from each other, but from the clever wires that try to bring them together.

In the beginning was Morse Code, much beloved by boy scouts and lantern-jawed Royal Navy officers, but dismissed as inadequate by telex and teletype engineers. In 1880 J E M Baudot invented what has become known as the Baudot Code, which by the 1950s had become the main standard for international telegraph communications.

This is a code made up of five binary digits (or bits) which, with a system similar to the 'shift' key on a typewriter, allows the 32 unique combinations to represent 58 distinct characters – six are duplicated so they can be used in either mode (figure 1). But if there

FIGURE 1: BAUDOT

Baudot Code Characters

Letters						Figures
A	1	0	0	0	0	1
B	0	0	1	1	0	8
C	1	0	1	1	0	9
D	1	1	1	1	0	Ø
E	0	1	0	0	0	2
F	0	1	1	1	0	NA
G	0	1	0	1	0	7
H	1	1	0	1	0	+
I	0	1	1	0	0	NA
J	1	0	0	1	0	6
K	1	0	0	1	1	(
L	1	1	0	1	1	=
M	0	1	0	1	1	)
N	0	1	1	1	1	NA
O	1	1	1	0	0	5
P	1	1	1	1	1	%
Q	1	0	1	1	1	/
R	0	0	1	1	1	–
S	0	0	1	0	1	.
T	1	0	1	0	1	NA
U	1	0	1	0	0	4
V	1	1	1	0	1	'
W	0	1	1	0	1	?
X	0	1	0	0	1	,
Y	0	0	1	0	0	3
Z	1	1	0	0	1	:
LS	0	0	0	0	1	LS
FS	0	0	0	1	0	FS
CR	1	1	0	0	0	CR
LF	1	0	0	0	1	LF
ER	0	0	0	1	1	ER
NA	0	0	0	0	0	NA

Symbols: LS = Letter Shift, FS = Figure Shift, CR = Carriage Return, LF = Line Feed, ER = Error, NA = Not Assigned, Space = LS or FS.

was a mistake in transmitting a shift character, you received special symbols instead of letters, which could be very confusing.

However, in the 1950s, the computer was rearing its ugly head. Computers are binary; they use only 0s and 1s. To represent all the 26 lower-case characters, the upper-case characters, the numerals 0-9, punctuation and special characters (such as *"/@£_ &'+=?), many more symbols than the 58 Baudot Code characters are needed.

Virtually every different computer company came up with a different way of encoding these characters into binary numbers, but IBM (who else) came up with the winning formula. This was eventually refined into Extended Binary-Coded Decimal Interchange Code (EBCDIC) – figure 2.

This uses eight bits to define 256 unique characters (this is where the idea of calling eight bits a 'byte' comes from) which not only include all the upper- and lower-case letters, the numerals and special symbols, but also lots of special machine-dependent codes that do things like ring bells on terminals and order a printer to start a new line.

If you study figure 2 you will see why it is a terrible mistake to type a capital 0 instead of zero or a capital I instead of a one – a computer thinks they look totally different. For a start all numbers begin with the binary code 1111. The code for capital I is 11001001, whereas for one it is 11110001.

Twenty years ago an attempt was made to try and bring some order to this chaos – the American National Standards Institute (ANSI) defined a national standard for data

FIGURE 2: EBCDIC

	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	NULL					HT										
0001				TM		LF	BS			DC1	DC2	DC3	STOP			
0010	DS	SST	FDS									VT	FF	CR	SO	SI
0011										EM	SUB	ESC	FS	GS	RS	US
0100	SP										£	.	<	(	+		1
0101	&										!	$	*	)	;	—	
0110	–	/									Λ	'	%	-O-	>	?	
0111											:	#	@	'	=	"	
1000		a	b	c	d	e	f	g	h	i						
1001		j	k	l	m	n	o	p	q	r						
1010			s	t	u	v	w	x	y	z	SOH	DLE	CAN	NAK	SYN	ETB
1011										STX	ETX		EOT	ENQ	ACK	BELL
1100		A	B	C	D	E	F	G	H	I						CAK
1101		J	K	L	M	N	O	P	Q	R						DAK
1110			S	T	U	V	W	X	Y	Z						DOS
1111	0	1	2	3	4	5	6	7	8	9						◇

For example: Code for A = 1100 + 0001

FIGURE 3: ASCII

COLUMN	0	1	2	3	4	5	6	7
ROW / BITS 4321 765	000	001	010	011	100	101	110	111
0	0000	NUL	DLE control P	SP	0	@	P	\	p
1	0001	SOH control A	DC1 control Q	!	1	A	Q	a	q
2	0010	STX control B	DC2 control R	"	2	B	R	b	r
3	0011	ETX control C	DC3 control S	#	3	C	S	c	s
4	0100	EOT control D	DC4 control T	$	4	D	T	d	t
5	0101	ENQ control E	NAK control U	%	5	E	U	e	u
6	0110	ACK control F	SYN control V	&	6	F	V	f	v
7	0111	BEL control G	ETB control W	'	7	G	W	g	w
8	1000	BS control H	CAN control X	(	8	H	X	h	x
9	1001	HT control I	EM control Y	)	9	I	Y	i	y
10	1010	LF control J	SUB control Z	*	:	J	Z	j	z
11	1011	VT control K	ESC	+	;	K	[	k	{
12	1100	FF control L	FS	,	<	L	/	l	|
13	1101	CR control M	GS	—	=	M	]	m	}
14	1110	SO control N	RS	.	>	N	⌒	n	~
15	1111	SI control O	US	/	?	O	—	o	DEL

bit
7— —1

Example: Code for A = 100 | 0001

LEGEND for Control Codes in Columns 0 and 1:

NUL	*Null*
SOH	*Start of Heading*
STX	*Start of Text*
ETX	*End of Text*
EOT	*End of Transmission*
ENQ	*Enquiry*
ACK	*Acknowledge*
BEL	*Bell [audible signal]*
BS	*Backspace*
HT	*Horizontal Tabulation [punched card skip]*
LF	*Line Feed*
VT	*Vertical Tabulation*
FF	*Form Feed*
CR	*Carriage Return*
SO	*Shift Out*
SI	*Shift In*
DLE	*Data Link Escape*
DC1	*Devite Control 1*
DC2	*Device Control 2*
DC3	*Device Control 3*
DC4	*Device Control 4*
NAK	*Negative Acknowledge*
SYN	*Synchronous Idle*
ETB	*End of Transmission Block*
CAN	*Cancel*
EM	*End of Medium*
SUB	*Substitute*
ESC	*Escape*
FS	*File Separator*
GS	*Group Separator*
RS	*Record Separator*
US	*Unit Separator*
DEL	*Delete*

transmissions between computers. The protocol chosen was not EBCDIC (at that time IBM was less powerful than the US government) but a new code called ASCII (American Standard Code for Information Interchange).

The ASCII set uses only seven bits to give 128 characters – 32 special codes and 96 alphabetic, numeric and special symbols. (figure 3). The other bit in a byte can be used for 128 graphics characters, as a parity bit or anything else you can dream up. (A 'parity bit' is for error control: it is made odd or even depending on the number of 1s in the byte – if the signal is degraded and a bit lost, the parity bit will show an error).

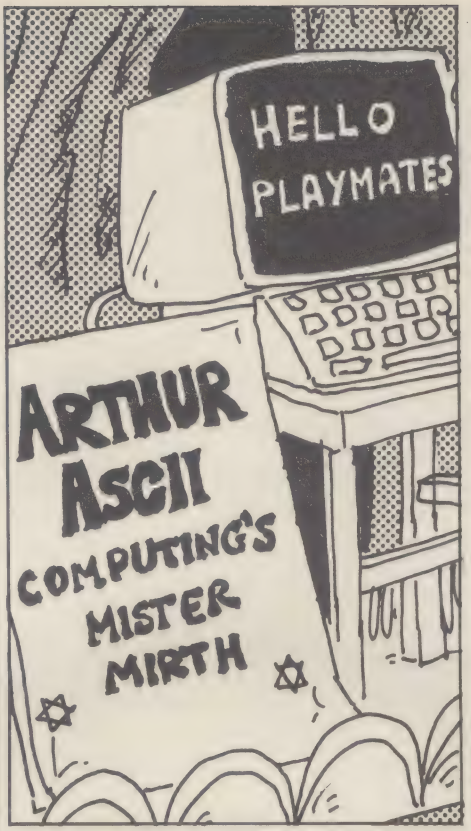
Twenty years later, IBM's EBCDIC is still used internally in almost every mainframe and minicomputer, although ASCII rules on the micros.

ASCII was designed to let computers talk to each other, with a number of codes to make sure each computer knows what's going on (for example the ETB code: figure 3). The same codes also represent a set of control characters: codes generated by pressing a letter of the alphabet with the control key.

Things didn't turn out quite as expected by the American standard setters (a problem standard setters must be used to by now) – most developers of micros chose to use the ASCII code, but not always in the same way.

Nowadays most micros will store text files in ASCII code (there are exceptions, for example the Sinclair ZX80 and 81). Many will also use the ASCII codes to perform functions like ringing the bell (or bleeping the speaker), and backspacing.

But other ASCII control character codes have different uses on different machines. For example, the CP/M operating system uses control C (which in ASCII represents end of text) to restart the system (known in the jargon as a 'warm boot').



ASCII alone doesn't offer much hope for micro users who want in-depth chats with other micros because it doesn't provide a set of protocols

Most versions of the Basic programming language have a command you can use to get the machine to output an ASCII character. For example, suppose you wanted to get the micro's bell to ring while the program is running. You would usually insert the statement CHR$(7), where seven is the decimal value of the appropriate ASCII binary code. If you wanted to find out the decimal ASCII value of a particular character, you would use the command ASC. Thus ASC("A") would return the value 65.

Despite this level of standardisation, ASCII alone does not offer much hope for micro users wanting to have in-depth chats with other micros. For a start, ASCII contains no standard for the speed at which the micros would communicate, nor for starting off the conversation (the 'handshake').

It is only useful for exchanging text files, and for sending instructions to machines that expect their instructions in ASCII form. What ASCII does not provide, in short, is the set of protocols that both machines need to use to be able to communicate.

ASCII does have a use for people with a penchant for radio hamming. You can buy converters for turning ASCII code into Morse code, and thus messages, including program listings, could be prepared on the micro before being sent in dot and dash form.

By Geoff Conrad, features editor on *Datalink*.

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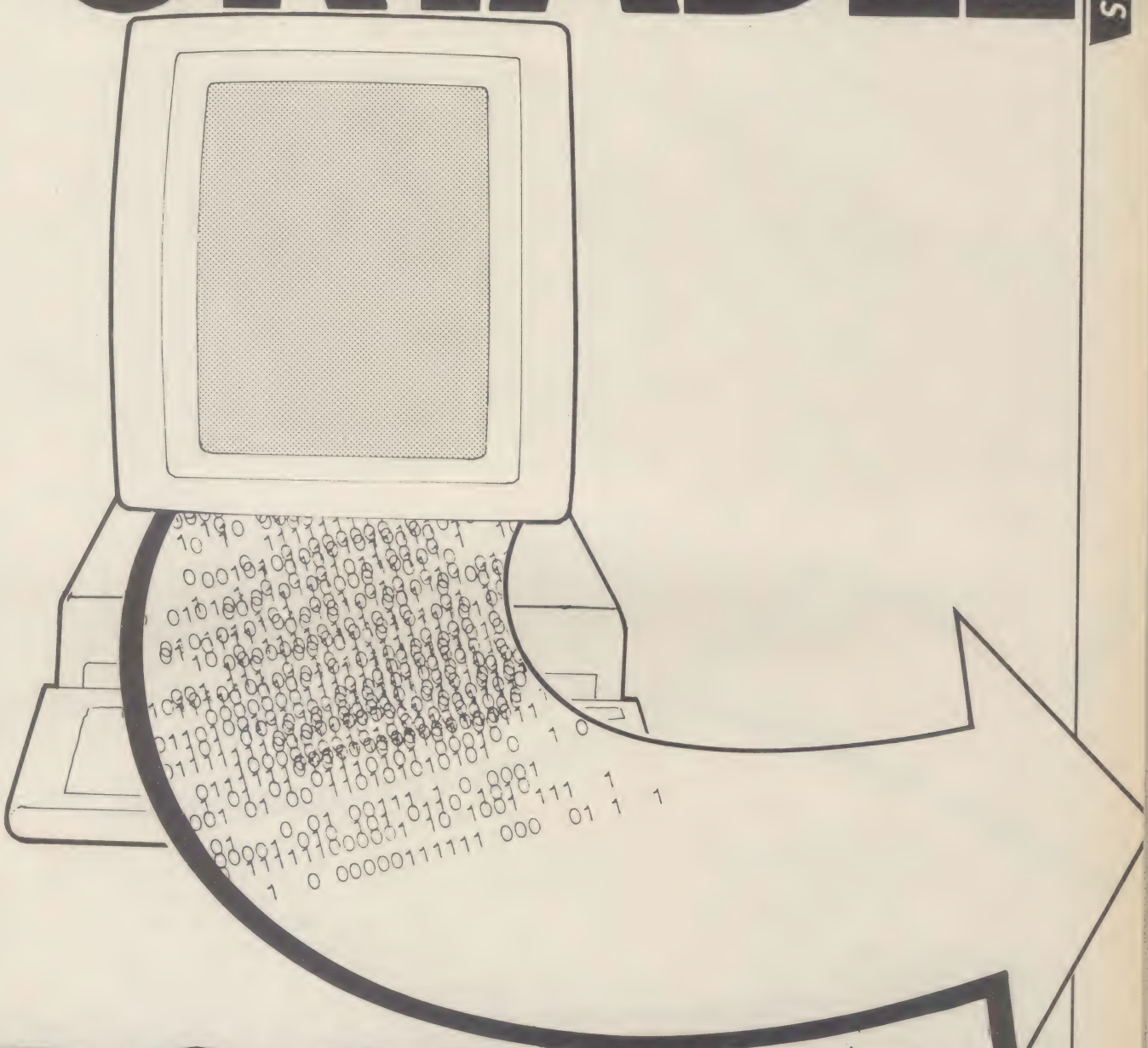


Program portability results from foresight and discipline on the part of the program writer. In the early days of broadcasting, there were not only fixed and portable wireless sets but also 'transportables', which could only be moved with the help of a wheelbarrow. Many good computer programs which would be better described as transportable rather than portable, require an effort which increases with the degree of incompatibility between machines.

The first portability principle is to separate and minimise program parts that are machine dependent. Also there should be clearly defined interfaces with the machine.

To some extent, you will find that most micro types are incompatible with each other. Different machines have different ways of handling and processing data. Because of this, most software is partly machine dependent.

The media used to store most software, cassette tapes and floppy disks, are of little use for transporting programs between

machines. Even tapes with programs for the Sinclair ZX81 can't be used with the Sinclair Spectrum. With the 5¼-inch floppy disk the position is just as bad. Each system has its own way of organising and packing the data onto the disk: the disk format. Therefore, one type of micro can't read another type's disks. The only industry wide-disk format standard is for 8-inch disks, which use a format developed by IBM.

One of the major portability problems with cassette-based machines is that most manufacturers have their own idea of what Basic language should be. Most versions of Basic use a common set of commands, like PRINT, LOAD, RUN, GOTO and GOSUB. But they each use commands not used elsewhere, which leads to problems when you want to use a Basic program on a machine it wasn't written for.

One of the oft-mentioned advantages of the CP/M operating system (the software that administers the operation of the machine) is that it provides access to an enormous pool of programs. However, this is not because a disk from one CP/M micro will slot into another. Life just isn't that easy. Those disk formats still have to be the same, and in most cases aren't.

The reason for CP/M's popularity is that it is extremely adaptable. It can be put on just about any micro that uses a Z80, 8080 or in a high level language (for example Basic). With most versions of Basic (for example that used on the ZX81 or the BBC Micro), the program is translated line by line, and always stored in the form of source code (which means translation takes place every time you run the program). Many micros that use disks offer compiled languages, where the source code is translated by a program called a compiler into something the machine can process (the object code) all in one go. When a compiler is used, programs are usually stored in the form of an object code.

Current wisdom is that the easiest way to transfer programs is to use the source code. This way it is easier to check that the program hasn't been altered during transfer.

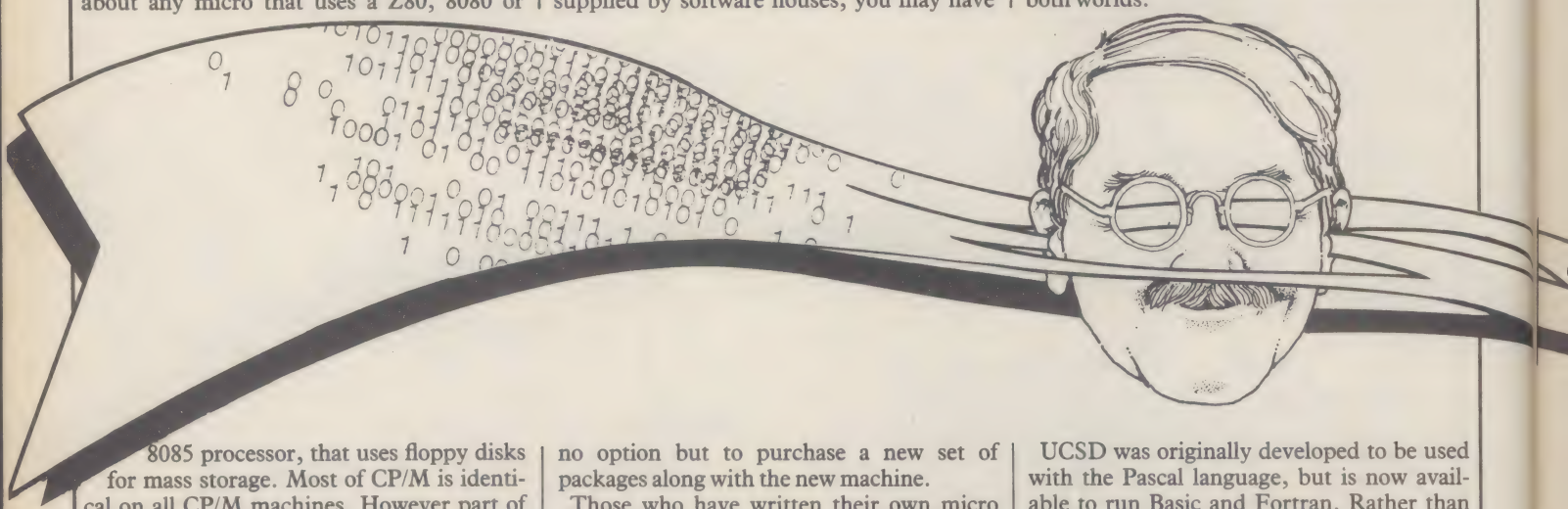
You will then need the same type of compiler on the target machine, as a different compiler may not understand all the commands used in the source code. On top of this, you will have to ensure there's enough memory to cope with the program and the data it uses.

Those users with ambitions to move their software onto a new machine, perhaps if they have just replaced their existing kit, may well feel depressed by the problems they will face. Sadly there is good cause for their depression. If you use software packages supplied by software houses, you may have work with the standard compiler. There is as yet no such standard for Basic, but the most widely used version for disk based machines is MBasic, from a US software house called Microsoft. MBasic is therefore a sensible choice if you want to write in Basic. In the case of CP/M, you can use the low level assembler provided, because it should run on all CP/M machines.

CP/M and other popular operating systems (like Unix, a very powerful software development system widely used on minicomputers and now becoming available on micros) are much imitated.

These are sometimes incompatible with the software they were designed to imitate (though they may be easier to use or more efficient), so (principle number three) beware of imitations, at least until it's obvious that a lot of software can be transported from the imitated to the imitator.

When a program is compiled, it is stored in the form understood by the particular machine it is to run on. At this level you get least portability. But at least you don't have to go through the often agonising process of recompiling the program. One operating system, called the UCSD p-system (developed by the University of California at San Diego and now supplied by the Californian firm Softech), tries to get the best of both worlds.



8085 processor, that uses floppy disks for mass storage. Most of CP/M is identical on all CP/M machines. However part of it, the Basic Input/Output System (the BIOS) is responsible for interfacing with the hardware. The BIOS smooths over the hardware's peculiarities. Any software package written for the CP/M operating system will run on a CP/M machine, the only problem is getting the software into the machine's memory.

Given that the disk formats will be incompatible, the best way to transfer software is via the machine's serial port (the plug which connects to peripherals such as printers). You need two machines: one running the software you want, the other being the target machine. You also usually need software on both machines that is responsible for administering the transfer. For CP/M the most popular software for this is called BSTAM, and comes from a company called Byrom Software. It will transfer the files between two CP/M systems.

When preparing the transfer you have to decide the form in which the software should be transferred. There are usually two options: in source or object form. Source code is what you actually write: a list of statements

no option but to purchase a new set of packages along with the new machine.

Those who have written their own micro software, and want to move it over to a new machine, will have even greater cause for concern. They are faced with the prospect of having to rewrite all their programs, entailing an enormous amount of effort. They may also want to sell their programs to run on other micros.

Programs can be written so they are easier to transport. This requires following a set of designing and writing principles.

The first portability principle is that you must separate and minimise the parts of the program that are machine dependent. Also, there should be clearly defined interfaces with the machine. This means using an operating system like CP/M, with its separate and clearly defined BIOS interface.

Using a high level language, like Basic, Pascal, Fortran or Cobol, helps ensure that the program will move over to a new machine, at least in source code form. If you use a high level language, it is best to use the version that conforms with one of the international standards (set by the International Standards Organisation, ISO) as any program conforming to the standard will

UCSD was originally developed to be used with the Pascal language, but is now available to run Basic and Fortran. Rather than compile down into the machine's individual code, it compiles into 'p-code'. This p-code is then interpreted into the machine code. All programs written using the UCSD operating system are stored in p-code, and will run on any UCSD system.

Softech has also developed a package, grandiloquently called the Universal Medium, which will allow a micro to read incompatible disk formats. The Universal Medium will probably cost about £150 (no price has been set).

The nearest the micro industry comes to any sort of standard is the ASCII character code, but not all micros use the same binary codes to represent letters of the alphabet, numerals and special characters like brackets. For example, the ZX81 has its own character code.

Since most micros use the ASCII code, you're fairly safe with it. But remember some translation might be required for some machines. There is far less standardisation on the particular characters a system uses to perform control functions, functions like moving the cursor around the screen, or

starting the printer.

Beware of language extensions. Many languages are supplied with a few extra commands. If these are used in your software, it won't run on a machine without those extensions.

Remember that different computers have different levels of accuracy, so if your program relies heavily on maths try to keep the level of accuracy to a minimum, or include some facility for adjusting the level of accuracy. A surprising example of this arises with the version of Basic supplied with the Sirius and IBM micros.

Both are less accurate than less powerful CP/M micros, like the Osborne, when using the supplied Basic. If possible, and if the language allows, write the program in small simple modules.

This will help overcome the problem of moving the software over to machines with smaller memory capacity.

If you're really serious about writing your software for use on other machines, it is worth using 8-inch rather than 5¼-inch floppy disks, because of the standardised 8-inch format. Most software houses distribute their software on 8-inch disks.

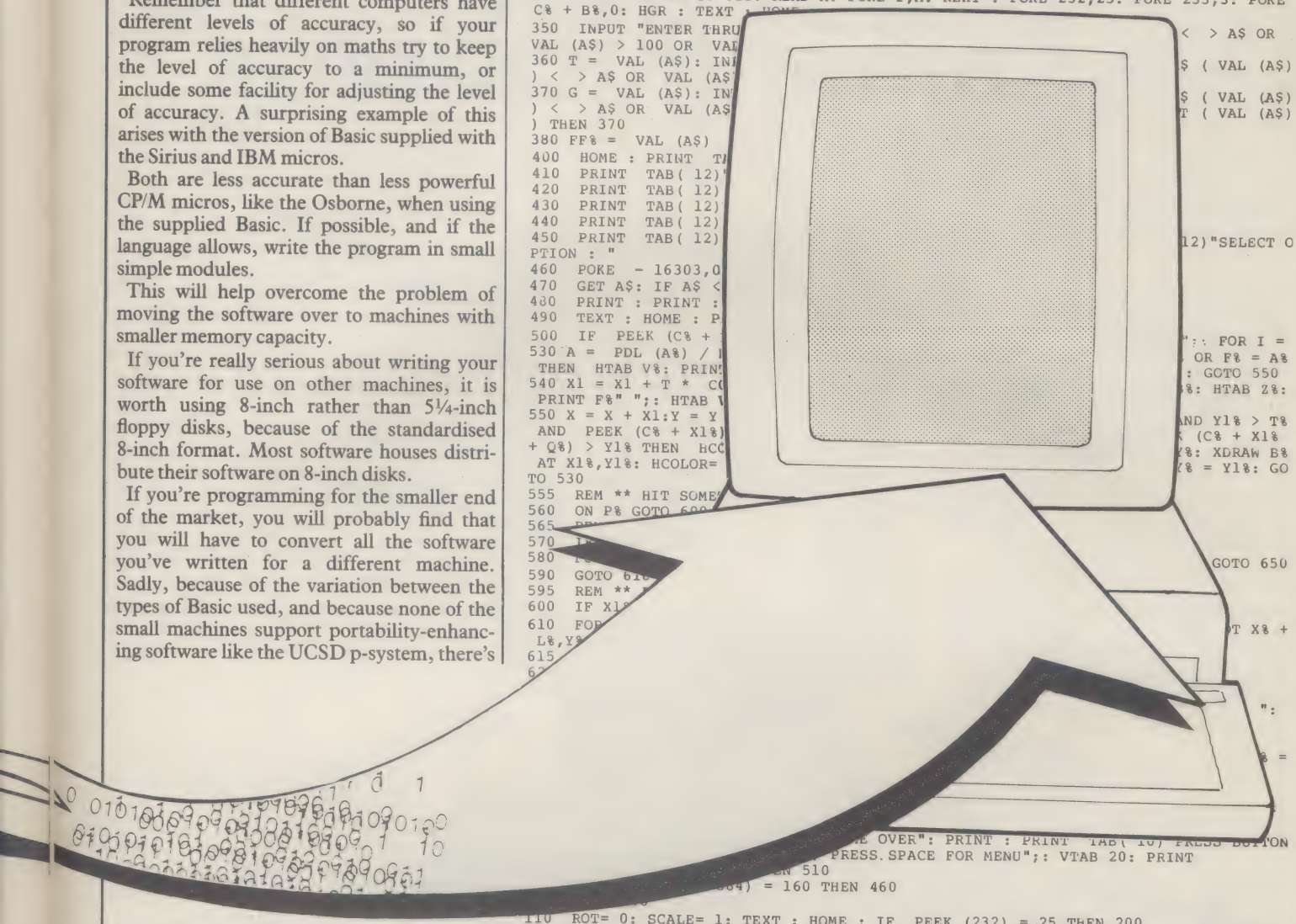
If you're programming for the smaller end of the market, you will probably find that you will have to convert all the software you've written for a different machine. Sadly, because of the variation between the types of Basic used, and because none of the small machines support portability-enhancing software like the UCSD p-system, there's nothing much you can do except wait for a standard Basic. This could prove to be the one used by Sinclair, given the ZX81's popularity.

As a final software transfer aside maybe we should ask: 'is the journey really necessary?'. With software rapidly becoming more expensive than the hardware, it could be easier and cheaper to buy a plug-in printed circuit board with the processor and operating system for a particular program to run in an otherwise 'foreign' machine.

This is already being done by people who buy the Softcard to plug into the Apple, thus turning it into a machine which will run CP/M software.

On the horizon one can see a micro consisting of little more than a chassis, ready to have an assortment of processor cards plugged into it, where programs select the processor they were written for. Of course all the software will have to be available in the right disk format, unless a standard format emerges. This may happen as new disk technologies become popular. A really comprehensive machine like that might need a very large wheelbarrow.

By Gordon Stevenson, product specialist, Micro Focus.



```
100 B% = 1:D% = 3:J% =  - 16287:H% = 10:C% = 28672:G% = 128:V% = 33:Z% = 15:T% =
 6:R% = 273:E% = 13:Q% = 6:C = 6.9999999:D = 81.169021:B = .448799:P = 3.141592:
D$ =  CHR$ (4)
110  ROT= 0: SCALE= 1: TEXT : HOME : IF  PEEK (232) = 25 THEN 200
120  DATA 162,0,134,249,162,32,134,250,160,0,177,249,73,255,145,249,200,208,247,
232,224,64,208,238,96,1,0,4,0,45,36,63,36,45,36,45,54,45,54,63,54,45,5,0
130  FOR I = 768 TO 811: READ A: POKE I,A: NEXT : POKE 232,25: POKE 233,3: POKE
C% + B%,0: HGR : TEXT : HOME
350  INPUT "ENTER THRU
VAL (A$) > 100 OR  VAL
360 T =  VAL (A$): IN
) <  > A$ OR  VAL (A$
370 G =  VAL (A$): IN
) <  > A$ OR  VAL (A$
) THEN 370
380 FF% =  VAL (A$)
400  HOME : PRINT  TA
410  PRINT  TAB( 12)"
420  PRINT  TAB( 12)
430  PRINT  TAB( 12)
440  PRINT  TAB( 12)
450  PRINT  TAB( 12)
PTION : "
460  POKE  - 16303,0
470  GET A$: IF A$ <
480  PRINT : PRINT :
490  TEXT : HOME : P
500  IF  PEEK (C% +
530 A =  PDL (A%) / 1
 THEN  HTAB V%: PRINT
540 X1 = X1 + T *  CO
 PRINT F%" ";: HTAB V
550 X = X + X1:Y = Y
 AND  PEEK (C% + X1%)
+ Q%) > Y1% THEN  HCO
 AT X1%,Y1%: HCOLOR=
TO 530
555  REM ** HIT SOME
560  ON P% GOTO 600
565  REM
570  I
580  F
590  GOTO 610
595  REM **
600  IF X1
610  FOR
 L%,Y%
615
620
                                                    < > A$ OR
                                                    $ ( VAL (A$)
                                                    $ ( VAL (A$)
                                                    T ( VAL (A$)
                                                    12)"SELECT O
                                                    ": FOR I =
                                                     OR F% = A%
                                                    : GOTO 550
                                                    %: HTAB Z%:
                                                    ND Y1% > T%
                                                    (C% + X1%
                                                    %: XDRAW B%
                                                    % = Y1%: GO
                                                    GOTO 650
                                                    T X% +
                                                    ":
                                                    % =
E OVER": PRINT : PRINT  TAB( 10) PRESS BUTTON
 PRESS.SPACE FOR MENU";: VTAB 20: PRINT
N 510
04) = 160 THEN 460
```

```
110  ROT= 0: SCALE= 1: TEXT : HOME : IF  PEEK (232) = 25 THEN 200
120  DATA 162,0,134,249,162,32,134,250,160,0,177,249,73,255,145,249,200,208,247,
232,224,64,208,238,96,1,0,4,0,45,36,63,36,45,36,45,54,45,54,63,54,45,5,0
130  FOR I = 768 TO 811: READ A: POKE I,A: NEXT : POKE 232,25: POKE 233,3: POKE
C% + B%,0: HGR : TEXT : HOME
800  HGR : VTAB 21: HTAB 15: PRINT "LOAD MOON.": PRINT : PRINT  TAB( 10)"
OON'S NUMBER "
810  VTAB 23: HTAB 30: CALL  - 868: INPUT A$: IF A$ <  >  STR$ ( VAL (A$)) OR
AL (A$) <  >  INT ( VAL (A$)) OR  VAL (A$) < 0 THEN 810
820  ONERR  GOTO 840
830  PRINT D$"BLOAD MOON£"A$: GOTO 850
840  VTAB 23: HTAB 1: CALL  - 868: PRINT  TAB( 10)"MOON£"A$" DOES NOT EXIST.":
OR I = 1 TO 1500: NEXT : POKE C% + B%,0: GOTO 460
850  HCOLOR= D%: FOR I = B% TO 278: HPLOT I,159 TO I, PEEK (C% + I): NEXT : HPLO
T 0,159 TO 0,0 TO 279,0 TO 279,159: GOTO 460
1010  VTAB 16: CALL  - 868: HTAB 19: INPUT A$: IF A$ <  >  STR$ ( VAL (A$)) OR
VAL (A$) < 1 OR  VAL (A$) > 100 OR  VAL (A$) <  >  INT ( VAL (A$)) THEN 1010
1020 K% =  VAL (A$): HGR : HCOLOR= D%: HPLOT 0,159 TO 0,0 TO 279,0 TO 279,159: F
OR I = B% TO 278
1030  IF  PEEK (J% + B%) > 127 THEN  HCOLOR= D%: GOTO 1050
1040 H = 9 +  PDL (A%) * 150 / 255: HCOLOR= D%: HPLOT I,H: FOR J = 1 TO K%: NEXT
 : IF  PEEK (J%) < G% THEN  HCOLOR= A%: HPLOT I,H: GOTO 1030
1050  HPLOT I,159 TO I,H: POKE C% + I,H: NEXT
1060  HOME : VTAB 22: PRINT  TAB( 14)"RE-DRAW (Y-N) ?";: GOSUB 860: HTAB 1: CALL
 - 868
1070  IF A$ = "Y" THEN A$ =  STR$ (K%): GOTO 1020
1080  PRINT "     DO YOU WANT TO SAVE IT ? (Y-N)";: GOSUB 860: IF A$ = "N" THEN 4
00
1090  HTAB 1: CALL  - 868: PRINT  TAB( 14)"ENTER NUMBER ";
1100  INPUT B$: IF B$ <  >  STR$ ( VAL (B$)) OR  VAL (B$) <  >  INT ( VAL (B$))
OR  VAL (B$) < 0 THEN  HTAB 27: VTAB 22: CALL  - 868: GOTO 1100
1110  ONERR  GOTO 1140
1120  PRINT D$"VERIFY MOON£"B$: HTAB 1: VTAB 22: CALL  - 868: PRINT "MOON£"B$" A
LREADY EXISTS. OVERWRITE?";: GOSUB 860
1130  IF A$ = "N" THEN  HTAB 1: CALL  - 868: GOTO 1080
1140  IF  PEEK (222) <  > 6 THEN 1170
1150  VTAB 1: PRINT : ONERR  GOTO 1170
1160  PRINT D$"BSAVE MOON£"B$",A"C%",L280": GOTO 400
1170  VTAB 22: CALL  - 868: HTAB 10: FLASH : PRINT "     DISK ERROR     ": NORMA
L : FOR I = 1 TO 2500: NEXT : GOTO 400
```

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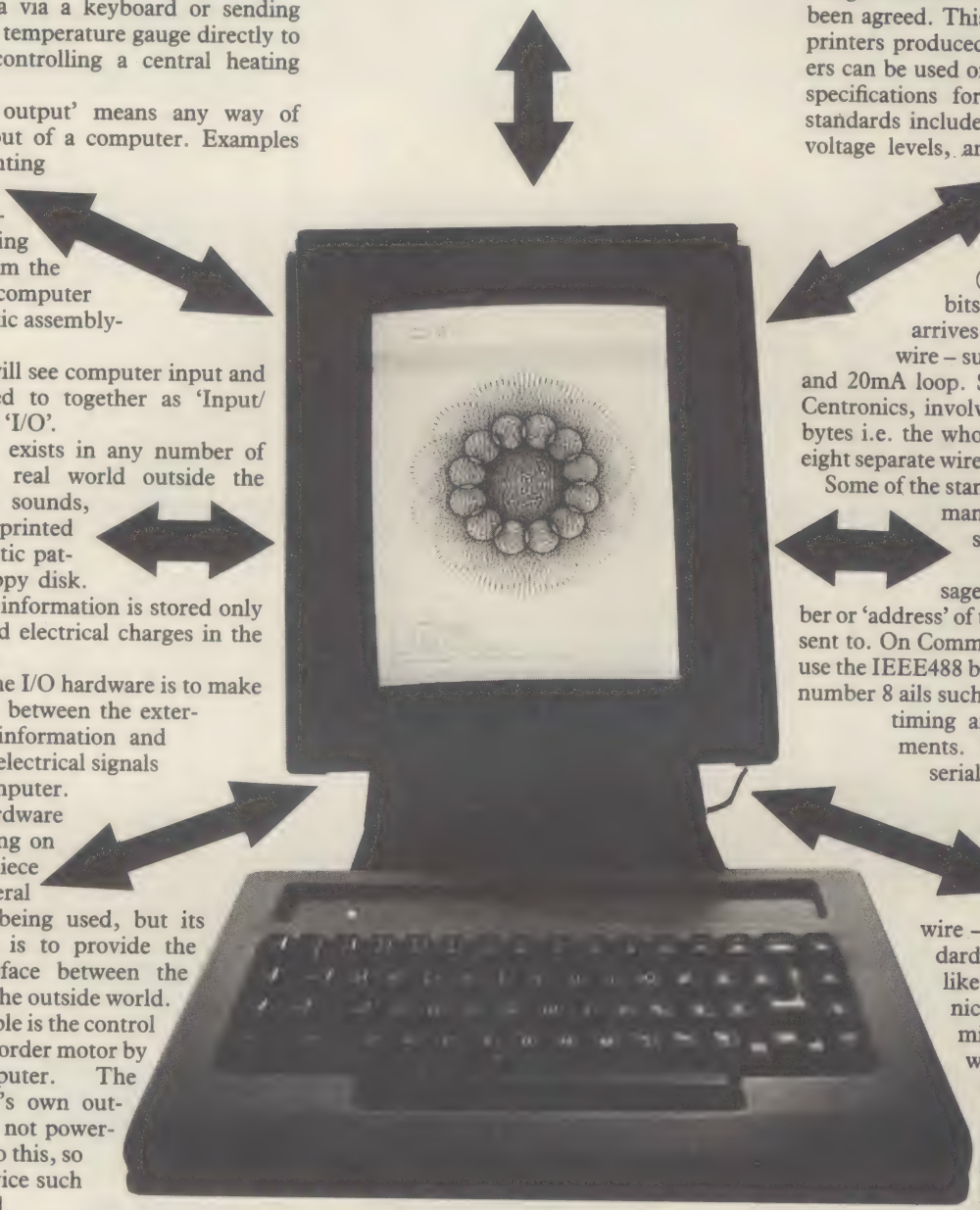
INPUT OUTPUT

What is input and output, and how does it relate to using a micro? What should I know about it?



The world of computer input and output straddles the boundary between hardware and software. This means that to understand it you need to know at least a bit about both sides.

The phrase 'computer input' covers any means of getting information into a computer – such as reading data from a cassette, typing in data via a keyboard or sending signals from a temperature gauge directly to a computer controlling a central heating system.

'Computer output' means any way of getting data out of a computer. Examples include printing text, storing data on a cassette and sending commands from the Fiat factory computer to those operatic assembly-line robots.

Often you will see computer input and output referred to together as 'Input/Output' or just 'I/O'.

Information exists in any number of forms in the real world outside the computer; as sounds, temperatures, printed text, or magnetic patterns on a floppy disk. In a computer information is stored only as binary-coded electrical charges in the memory chips.

The job of the I/O hardware is to make the conversion between the external forms of information and the low power electrical signals used by the computer.

The hardware varies depending on exactly what piece of peripheral equipment is being used, but its main function is to provide the electrical interface between the computer and the outside world. A simple example is the control of a cassette recorder motor by a microcomputer. The microprocessor's own output circuitry is not powerful enough to do this, so a switching device such as a relay is used.

Some modern I/O hardware can also perform error checking and the 'handshaking' between the sender and receiver of data. Handshaking is the little electronic 'conversations' which ensure that everything runs smoothly – 'Are you ready?' – 'Yes I'm ready' – 'Here is the data' – 'I've got the data' – etc). Although these jobs demand complex hardware, very large scale integration techniques can pack it all into one or two chips.

If every computer peripheral device had different interfacing requirements then each device would need its own special I/O hardware in the computer, and a lot of separate designs would be needed. Few of these would be used in large enough quantities for it to be economical to design and produce specialised interface chips.

To simplify both hardware and software design a number of standard interfaces have been agreed. This means, for instance, that printers produced by different manufacturers can be used on the same computer. The specifications for these data transmission standards include electronic details such as voltage levels, and any timing and handshaking requirements. Some standards involve serial transmission of bytes (bytes being groupings of bits, normally eight), i.e. data arrives one bit at a time down one wire – such as the RS232 standard, and 20mA loop. Some, like IEEE 488 and Centronics, involve parallel transmission of bytes i.e. the whole byte arrives at once on eight separate wires.

Some of the standards are designed so that many devices can share the same set of wires (or 'bus'). In such cases the messages must include the number or 'address' of the device the data is being sent to. On Commodore Pet systems, which use the IEEE488 bus, the disk drive is device number 8 ails such as voltage levels, and any timing and handshaking requirements. Some standards involve serial transmission of bytes (bytes being groupings of bits, normally eight), i.e. data arrives one bit at a time down one wire – such as the RS232 standard, and 20mA loop. Some, like IEEE 488 and Centronics, involve parallel transmission of bytes i.e. the whole byte arrives at once on eight separate wires.

Some of the standards are designed so that many devicise and interpret the input signals and to produce the right output signals in the right order. Sometimes the data stored in the computer is very similar in form to the signals used by the hardware. For example text can be stored internally in ASCII (American Standard Code for Information Interchange) which is the code that most printers use. In this case the software required is fairly simple. If the coded forms stored in the memory are very different to those used by the hardware then the software gets complicated.

I/O software is usually split into several layers, each with a clearly-de-

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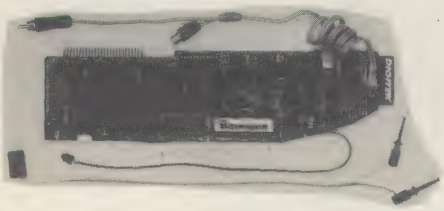

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This new 80 column card is the most advanced available with features like: 9*10 matrix, 3 scrolling speeds, shift lock, user definable graphics, supports all applesoft commands & applewriter II.
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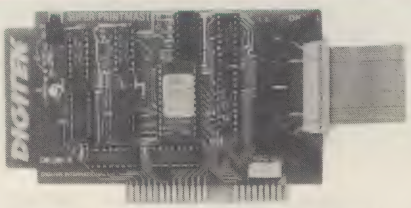

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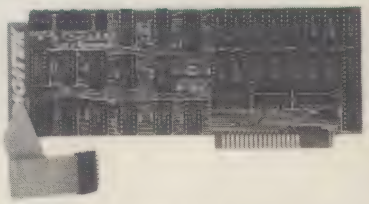

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These cards use the latest low power D RAM chips and can be used for high speed disk emulation in Basic, CP/M or Pascal. Visicalc Expand software available, can also be used as printer buffer with Super Printmaster III.
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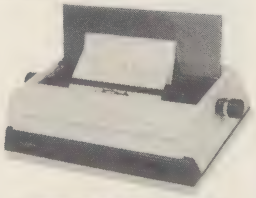

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fined area of 'responsibility'. This makes design and modification easier.

At the bottom level of I/O software are the 'driver' routines. These perform the most tedious and device-specific tasks such as timing of the signals sent and the handshaking for each byte. The driver routines usually work on a byte-by-byte basis. Sometimes they also perform the basic code conversions (e.g. from ASCII to EBCDIC – which is another standard character code). If the I/O hardware detects an error it will report it to the driver routine which will not usually do anything about it itself. It will just note the error and inform the next level of software, the 'protocol' routines.

The protocol routines pass bytes for transmission one at a time to the driver software or receive them one at a time. The routines will produce and answer standard messages which show the start and end of blocks of data. They are particularly important when dealing with a relatively 'intelligent' external device – such as another computer. Protocol is vital in networking systems (where several computers are linked together so that they can share expensive items such as disk drives and printers, and where data can be passed easily from one computer to another). These protocol routines will also perform such functions as calculating check totals of blocks of data and rechecking them. If the check totals do not tally between receiver and transmitter units then the protocol routines at each end will probably try to retransmit the data several times before giving up and reporting to the next higher level of software.

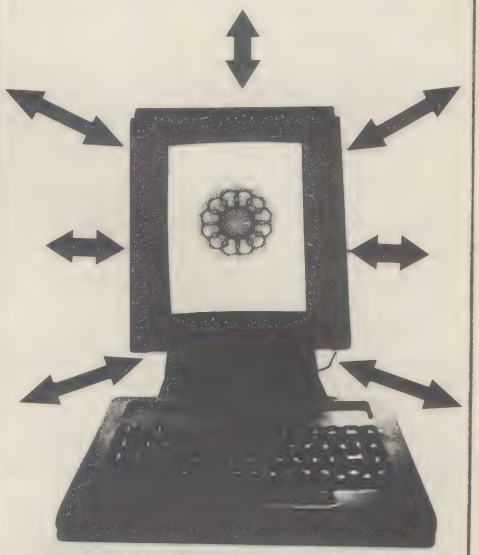
One step above the protocol routines are the I/O utility routines. Utility routines perform standard jobs required by many programs, such as loading a Basic program from cassette or floppy disk, or printing out a text-file.

These utility routines vary widely according to the job. Most of the parts of the software that are specific to particular makes and types of hardware are at the driver and protocol levels.

As an example, when a document is printed by a word processor the text can be 'right justified' (lined up with the right-hand margin) in one of two ways. For simple printers extra spaces are inserted by the software to pad out each line to the same length. For more sophisticated printers special codes are sent to make the printer itself control the spacing between all the letters in the line to fit the required width. These sort of details are covered by the utility routine which performs the printing. If the printer is changed the utility routine must be changed too. However, if the same printer is used, but with a different interface, then the changes occur at the lower, driver levels.

The software top level is the application program. This concentrates on the overall task, such as editing a document (word processing) or calculating a payroll. When data is needed from outside the computer or when results are to be transmitted the application program calls up the appropriate I/O utility routine.

When using a word processor program, for example, to edit a file on disk, several I/O operations occur. First, the file must be 'opened' for reading. The application program passes the file name to the Disk Operating System (DOS – a set of utility routines for handling data on disk drives). The DOS makes the disk drive read the directory information from the disk and send it back to the computer. The DOS checks this to find the location of the file on the disk. If everything checks out the DOS will report 'satisfactory completion' of the operation to the word processor program. This may then go on to open a new temporary file for storage of the edited text. This time the DOS will search the directory to make sure that there is space still available on the disk and that no file already exists with the same name.



INPUT OUTPUT

One devious technique is the 'interrupt', which makes the processor apparently do two things at once

Of course not every computer system needs the sophistication of all these levels of software. In particular the separate protocol level will be used mainly in high-powered networking systems only. In something relatively simple, such as a microprocessor-controlled sewing machine, there will only be driver and application levels of software. It could even be the application software that drives the hardware directly.

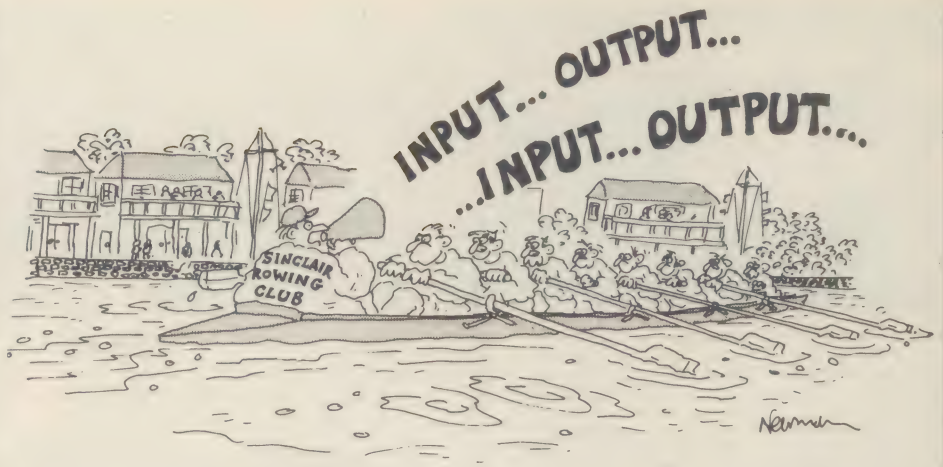
The advantages of these layers of I/O software show up best when changes are needed. The operating system CP/M is a good example of this approach. It is designed as a standard operating system for a wide range of computers. It comes in two parts; the BIOS (Basic Input/Output System) contains the machine-specific driver routines and must be amended for each different computer, and a set of utility routines to handle the disk files, printer and screen output and keyboard input. These utilities

will be essentially the same for all computers using CP/M. Some of them are contained in CP/M itself and some are stored as separate 'command' files on disk.

One particularly devious technique used in I/O driving is the 'interrupt'. This is a way of getting your processor to do two things apparently at once. The driver routine, which performs the input or output, does not actually do it when it is first asked. What happens is that a 'buffer' area in memory (used for temporary storage in the middle of an operation, and a different thing to a hardware 'buffer') is filled with the data for outputting and the higher level programs may continue working if they wish. When the output hardware and output device are ready for the next piece of data, an 'interrupt' signal is sent to the processor (into the 'interrupt request' pin of the microprocessor chip). The processor stops what it is doing and jumps to a specific routine which includes the I/O driver which sends the next byte of data. After this 'Interrupt Service Routine' (ISR) has been performed, the processor continues where it left off in the application program as though nothing had happened.

Similarly input routines can use interrupts. The 'interrupt-driven' driver routine loads data into an area of memory as it arrives. Each arrival is signalled by an interrupt which calls the driver. The application program may then retrieve the data from the memory area when it needs it.

To an application program then, any external device may look just like an area of memory, with some rules for requesting the transfer of data in and out of that area.



These techniques make input and output more efficient. An application program requiring a print-out does not have to wait for it's completion before continuing with its processing. It only has to send the print data to the lower level routines which will transmit the data on an interrupt basis. It may even happen that the I/O routines store a large quantity of print-out data on disk to enable a longer 'queue' to be handled (called 'spooling' the output). This can be done without the application program having to worry about it at all. Many of the traditional computer I/O devices leave most of the data conversion to the human operator.

A better approach is to input or output the information more directly. For a long time computers have taken data straight from measuring devices or have controlled instruments directly. The problem with this is usually one of non-standard interfacing requirements for each piece of equipment. The standard IEEE488 bus was designed by Hewlett-Packard to standardise the transfer of data between its test equipment.

There is much research in voice input and output. Voice synthesis for output works fairly well with relatively cheap hardware. Such chips are available and it is quite easy to interface these with microcomputers. Voice recognition for input is much more difficult. A combination of sophisticated hardware and software is needed and so far the results are not good. **By Patrick Quick, a lecturer in computer science.**

Further reading – Micro processor Interfacing Techniques by Laks and Lesea

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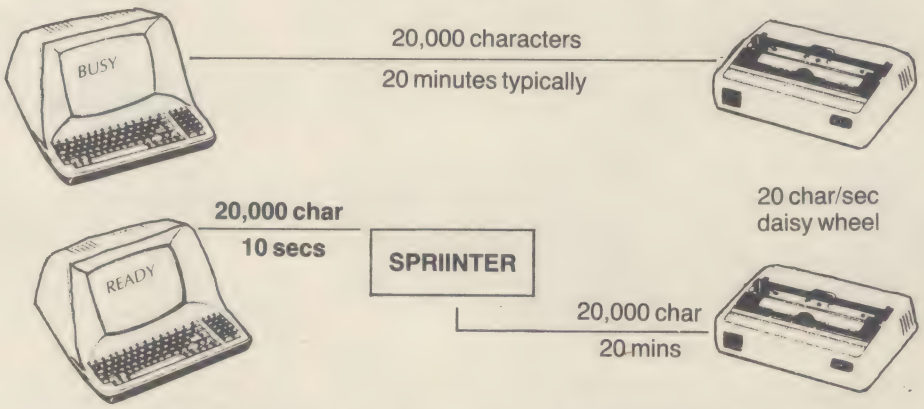

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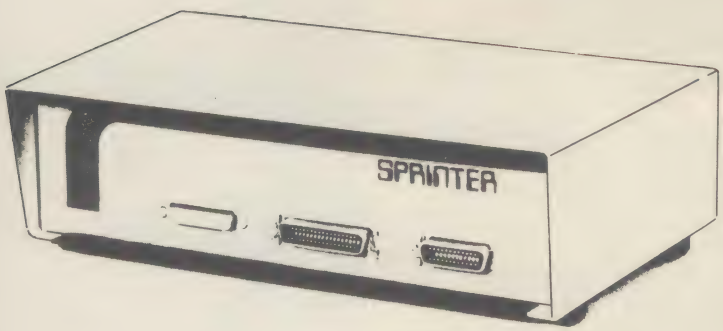

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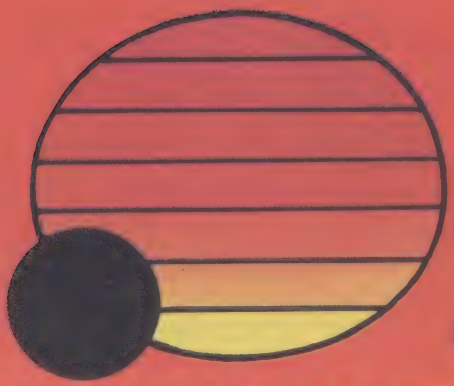

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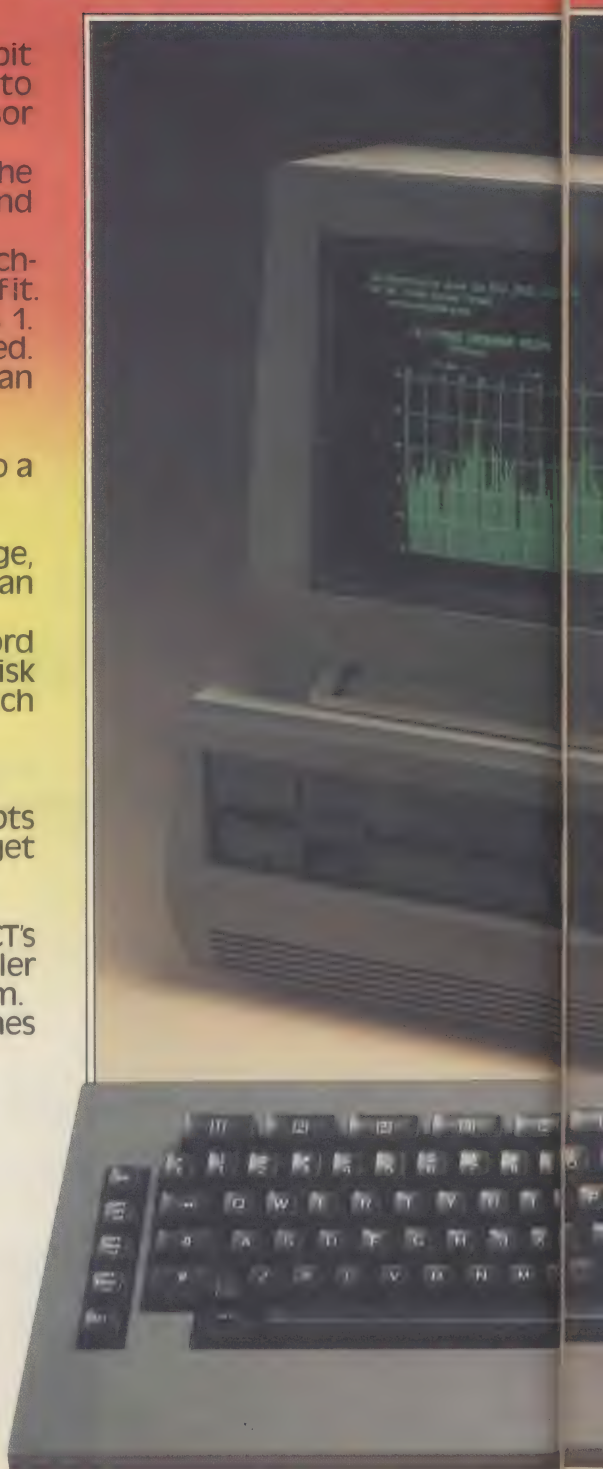

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DROP THE PRINTER A LINE

How easy is it to connect up a printer to a micro? Can I do it myself, and if so, what do I need to know about the interfaces?

Users who think they can connect a printer to their micro simply because they have the right plugs and sockets could, sadly, be in for a shock.

To communicate, pieces of computing equipment must share a set of common features. These comprise the interface, and involve a lot more than knowing the type of plug and socket.

In an attempt to simplify connections, the industry has adopted a number of 'standard' interfaces, which specify the features both pieces of equipment need.

When connecting to a printer, one of two interfaces is likely to be used: RS232 or Centronics (which was originally developed by a printer manufacturer of the same name, before other manufacturers started to use it). Some micros have one or both of these as standard (like the Superbrain) or as an optional extra on a plug-in board (as with the Apple). Either way, the interface you should use depends on the type of equipment you want to connect.

The major difference between RS232 and Centronics is that the former is for serial communications while the latter is for parallel. Serial communications are like a single lane road, allowing only one line of traffic at one time. Parallel is like a multi-lane road, allowing several lines of traffic at once.

The obvious advantage of a parallel interface, like Centronics, is that it's faster than a serial one. Faster printers usually have a parallel interface. Many dot matrix printers (like those made by Epson and Centronics itself) have parallel interfaces as standard. With Epson, you often have to pay for an extra plug-in board if you want RS232 as well.

Slower printing equipment, like daisywheel printers, usually have a serial interface. One advantage of having a serial interface on your micro is that you can connect to a huge range of peripherals.

With the Centronics interface, sometimes you will find no problem connecting to an interface. Perhaps your micro can be connected to the printer you want via the Centronics socket (or 'port') without need for further interfacing. The only way to find this out is to ask around, or see the printer and micro working together (by far the safest method).

RS232 is more of a bind. To use the RS232 interface you will need to establish that both pieces of equipment share the same features. Here's what to look for and ask when you're buying the printer:

First the micro and printer have to communicate at the same speed. Micros will usually push data out of the RS232 port at a rate ranging between 10 characters per second (cps) and 960 cps. The speed is usually measured in baud, where 10 cps is about the same as 110 baud and 960 cps the same as 9600 baud. The most common micro and printer speeds are 300, 1200, 4800 and 9600 baud.

With some micros, the operating system will allow you to change the speed of the RS232 port. The version of CP/M supplied with, say, a Superbrain, changes speed with a program called CONFIGUR. The speed of other micros is fixed, so you have to make the necessary changes using machine code.

Some printers allow you to vary the speed as well, usually by changing switches on the printed circuit board.

Sometimes, the printer will receive data at a certain speed, but be unable to print as fast. In this case both pieces of equipment will engage in a little handshaking.

Handshaking is the means by which the printer tells the computer 'Stop sending. I can't remember any more characters because the input buffer is full.' The input buffer is where the printer stores characters it hasn't yet had the time to print.

There are two ways of handshaking. One is called the hardware handshake. Here the printer varies the voltage on one of the lines.

If the voltage is high, the printer is able to receive data. If it is low, the micro must stop sending and wait.

The other method is called the software handshake. There are two common protocols for this: X-ON/X-OFF (sometimes called DC1/DC3), and ETX/ACK (pronounced 'et ack').

X-ON/X-OFF works in a similar way to hardware handshaking: the printer sends a signal, X-OFF, down the line usually reserved for sending messages to the micro. This tells the micro to wait. When the printer is ready again it sends the X-ON message.

ETX/ATK works as a question/answer session, with the computer asking the questions. A printer's input buffer is a passage in which all the characters to be printed queue up waiting their turn. The first character in is the first out (known as FIFO). At regular intervals the computer sends a character standing for 'Enquire transmit?' (hence ETX) which the printer won't print. Instead it sends back another message: 'Acknowledge OK to transmit' (hence ACK), which tells the micro to keep going. If the computer has sent, say, two ETX messages and received no ACK, it will stop.

For these handshaking methods to work, the micro must be able to send messages which the printer will understand and vice versa.

If the printer you're buying uses any of these protocols – be it hardware or software handshake – you will have to set up your computer to conform to them as well. Sometimes, this entails setting switches on the micro's printed circuit board. Other times it involves writing programs, called 'software drivers' in machine code. Both are beyond the competence of all but the expert, which is why you will normally have to engage the services of your dealer.

For the convenience of those who want to go it alone and write a set of drivers for the software handshake, we have printed a table (figure 1) of the hex and decimal values of the appropriate ASCII codes.

When all the protocols are set aright, and the speeds are the same, you are faced with having to solder the plugs, or get an engineer to do them. RS232 contains a specification for connecting Data Terminal Equipment (DTE) with Data Communications Equipment (DCE). In most cases the printer is wired as DTE and the micro as DCE.

An RS232 plug has 25 pins, with each pin individually identified by a number (usually imprinted next to the pin).

In figure 2 we list the function of each pin hole in a standard RS232 socket.

These functions have no obvious relevance to printers. Unlike the Centronics interface, RS232 was not designed for connecting to printers, but to modems (devices used to convert signals from a computer into a form that can travel reliably down a phone line). Concepts like data carrier detect make far more sense communicating by telephone.

If you have established that both micro and printer use the same software handshake, you should be safe connecting up only three of the pins: 2, 3 and 7. This is because all the handshaking signals form part of the communication on the transmit (pin 2) and receive (pin 3) lines. In this case you use colour coded wire to connect pins 2, 3 and 7 on one plug with the same pins on the other.

If you do this, it is advisable to

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connect pins 4, 5, 6, 8 and 20 together inside each plug.

The use of each pin becomes less obvious if you are wiring for a hardware handshake.

Different printer and micro manufacturers have different ideas about which pin should be used to carry the varying voltage indicating whether or not the printer is ready to receive. Most printers use pin 20 to indicate 'printer read'. Some micro manufactures link pin 20 on the computer's socket to CTS (clear to send) internally. Others use pin 6, or pin 8.

In every case, you'll need more wiring information. You will have to glean this from the printer manual and the micro's technical manual (which rarely forms part of the standard documentation, so you will have to buy it separately).

You have to find out how the RS232 ports are wired: which pins expect what. A word of warning: specifications to this level of complexity are usually written for experts in suitably impenetrable prose.

Two further points about wiring apply to both software and hardware handshakes.

It is advisable to wire up pin 1 (which is usually connected internally to the machine's chassis) to the connecting cable's screen (the wire webbing that surrounds the other wires, which itself is covered by the outer plastic sleeve), if there is one. Otherwise, you could use one of the spare lines. Some micros are wired as Data Terminal Equipment (DTE), rather than Data Communications Equipment (DCE), if so you will have to swop over the lines connected to pins 2 and 3 in one of the plugs (it doesn't matter which).

When you first open up a RS232 plug you may be alarmed at the size of the pins. It requires very fiddly soldering to wire a plug without solder bridges between pins, which would short out the signal. You will need a lightweight soldering iron, and a vice to clamp the plug. The cable will usually have more wires than you need, in which case you can ignore any that go spare. Just make sure they're out of harm's way.

The voltages carried by the lines are not the same as those used in the chips and internal circuitry. The data uses voltages of plus or minus 6 to 12 volts.

The handshaking signals use 0 to 12 volts. The voltages are then reduced to 5 volts for the equipment's circuitry. If there isn't provision for this, the buffers at both ends of the line will probably get burnt.

Bearing all this in mind, you may feel like relenting and getting an expert to make the connection.

In most cases this would be suitable, even if the Centronics interface is used. The Centronics ports on printers may be standard, but sometimes the micro end of things is less than standard.

There may be good reasons for going it alone, not least of which is that it gives you a greater understanding of how to link peripherals; an understanding which would stand you in good stead when you try to link other pieces of non-standard equipment.

The minimum you need is adequate documentation on both printer and micro, with access to it before you spend the money.

The importance of adequate documentation cannot be too strongly emphasised. Printer manuals have, by tradition, been lousy. They are of two sorts: too simple or too complicated.

The simple sort confine themselves to instructions on how to turn on, load the paper and replace the ribbon. The complex sort contain information for electronic engineers and nobody else.

Both are often translated from Japanese, but still read like Japanese. Companies like Epson are beginning to improve their documentation.

Check that there's a section in the manual giving full details on the printer interface and handshaking protocols.

One other point to watch for when examining the manual is dip switch lists. These show how various adjustments can be made to the printer's output by changing microscopic switches. The lists should clearly identify the function of each switch. As soon as the dip switches are set, you should be ready to print.

By Bob Robinson, managing director of the Byte Shop.

Figure 1: ASCII codes for software handshakes

Name	Code (Hex value)	Code (Decimal value)
ETX	03	3
ACK	06	6
X-ON (DC1)	11	17
X-OFF (DC3)	13	19

Figure 2: RS232 pin numbers and function, and direction of signal

Pin No.	Name	Direction DCE	Direction DTE	Function
1	FG			Frame ground/protective earth
2	Tx	→		Transmitted data
3	Rx	←		Received data
4	RTS	→		Request to send
5	CTS	←		Clear to send
6	DSR	←		Dataset ready
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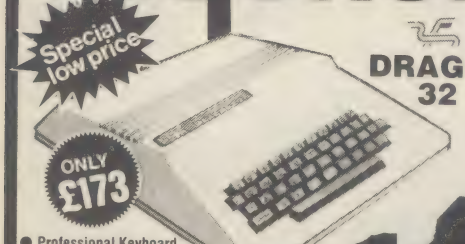

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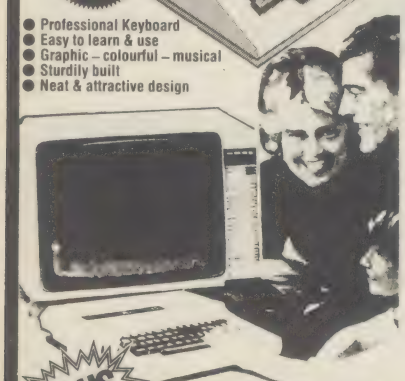

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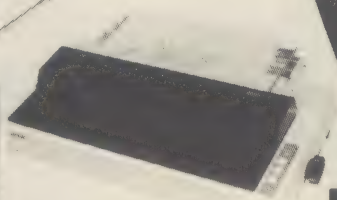

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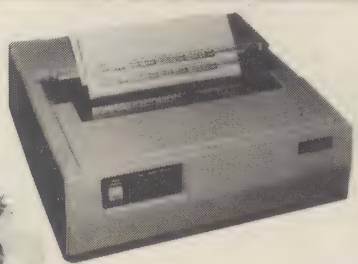

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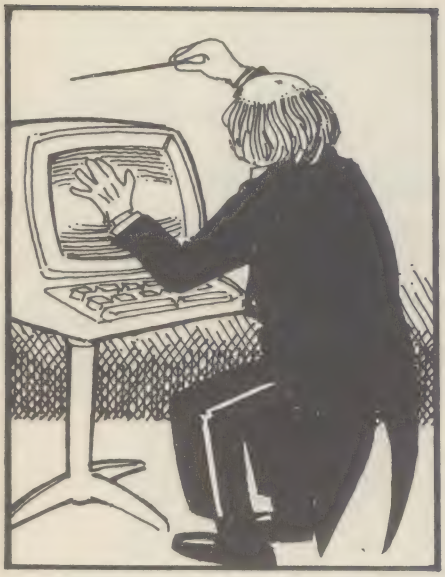

FAST FILE SEARCH

Is there a simple and fast Basic program for searching out entries in a large sorted file without having to run through each entry in the whole list? If so, what is it and how does it work?

Programming may be a rewarding activity, but at times it's frustrating. This section will overcome these frustrations by looking at various programming methods (in this issue Assembler, which allows you to program in something that closely resembles the machine's own code) and languages (Basic, plus any others you care to ask about).

The Binary Chop is a very common method of searching within a sorted file array, that is, file data in a recognisable order such as alphabetical or numerical.

In a very short file you can search sequentially, going from start to end looking for a match between what you are looking for and what you have found in the file.

However, with a large unsorted file this becomes very inefficient as many file access and 'IF' statements must be run and, according to the law of averages, you'll have to look through 50% of the file before you find your match. If you were searching for a word in a dictionary, you wouldn't start at the beginning and search until you found it. You'd make a guess, open the book, compare the word you wanted with those on the open page, and then open the book in a new position depending on your comparison – forwards or backwards.

This is exactly what the computer does when performing the Binary Chop (so-called because the computer chops a file in two). However, as the machine needs more precise instructions than you do, the guesswork is rather more regimented.

The first guess looks at the middle record, halfway through the file. This is compared with the item being searched for. If, for example, it is greater than what you want, the computer forgets all records above the halfway point and concentrates on those below. Its next guess looks at the middle record in the bissected file and compares again. This procedure is repeated with smaller numbers to search until the record you want is either found or proved not to exist. The latter case occurs when the 'file size' is down to one and still does not match with what is sought.

As the file being searched decreases by half each time a guess is made, this is a far quicker method than the sequential search, and its advantages increase with the file size. In a file of one million records you would need a maximum of 20 guesses.

The primary use of the Binary Chop is in memory index searching, where the main file is kept on disk and key (such as surname) and record number are called into memory in indexed form from the disk. A name can be entered from the keyboard and the array in memory searched very quickly using the Chop. When a match is found, the record number can then be used to call the whole record from disk, a much slower operation in comparison.

That's the theory. Now the practice. The program illustrated will let you experiment with this concept on your own system, as well as providing a useful working subroutine to add to your own programs. As this is the first in a series of articles on subroutines I'll go into more depth than usual on the structure of the program in question.

The first section (up to line 10) is the save command. To store the program on disk simply type GOTO1. This makes saving extremely simple and you should always save future versions back under the same program name and keep up-to-date copies on your workdisk. Lines 10-20 is a series of remarks giving such details as the program's name, language, author, start date and version date. The computer will ignore these but keep them in the program for your records. The next section (lines 20-100) gives all the variable names and functions. As each variable is thought of and named, it should be recorded in this or a similar way as, although you *think* you couldn't forget that XX stands for the number of records in a file, you might be in for a nasty surprise when you come back to the program after a break.

Lines 100-1000 set up tests for the subroutines by allowing you to set arrays of different sizes. When this is done, variables can be input to test out the search facilities. The Binary Chop subroutines come after line 1000. Subroutine 10000 produces a test array of its own containing numbers in order but seperated by random intervals. The routine itself will set three variables, array limits (variables telling the computer the top and bottom limits of your index) and hit check flags (variables which let the computer know if it's made a match). The principle of this testing is quite complex. It uses a Basic command, SGN, which returns one if a number is positive, zero if it is zero and minus one if it is negative. This means the program can work without using the more roundabout techniques of 'IF . . . THEN' as SGN will direct the program to one of three places by the use of ON . . . GOTO.

ON . . . GOTO will send the program to one of any number of places depending on the value of the variable following the ON clause. In this case there are three possible destinations, and two are actually specified as the third is simply to go on to the next line. If the

BINARY CHOP

```
  GOTO 10
1 SAVE "BINCHOP", A
2 STOP
3 REM
4 REM
10 REM
11 REM
12 REM BINARY CHOP PROGRAM – BINCHOP
13 REM
14 REM MBASIC
15 REM
16 REM ERIC V BAGSHAW 29.04.82
17 REM
18 REM VERSION 30.04.82 18:07
19 REM
20 REM
25 REM
30 REM A = INPUTED NUMBER
31 REM G() = SORTED RANDOM ARRAY
32 REM NO = NUMBER OF ELEMENT
33 REM C(1) = TOP OF ARRAY
34 REM C(2) = HIT CHECK
35 REM C(3) = BOTTOM OF ARRAY
36 REM N = NUMBER OF ELEMENTS
40 REM
45 PRINT "BINARY CHOP – TEST PGM"
50 PRINT "BINARY CHOP – TEST PGM"
51 CLEAR
55 REM
56 INPUT "NUMBER OF ELEMENTS", N
60 DIM G(N)
65 REM
70 GOSUB 10000: REM SET UP ARRAY
75 REM
100 INPUT "NUMBER"; A
101 REM
102 REM CHOP
103 GOSUB 1000
210 REM
220 PRINT "ANY MORE GUESSES (Y OR N)";
230 INPUT Q$ : IF Q$="Y" THEN 100
240 PRINT "ANY MORE ARRAYS TO TEST (Y OR N)";
250 INPUT Q$ : IF Q$ = "Y" THEN 40
300 END
1000 REM
1001 REM BINARY CHOP ROUTINE
1002 REM
1010 C(1)=N : C(2)=0 : C(3)=0
1020 NO=INT((C(1)+C(3))/2) : ON(2+(NO=C(3))) GOTO 1040, 1030
1030 C(SGN(A-G(NO))+2) = ON SGN(C(2))+1 GOTO 1020 1050
1040 PRINT"NO HIT ABOVE="G(C(1)) "BELOW="G(C(3)) : RETURN
1050 PRINT "HIT" : RETURN
10000 REM
10001 REM RANKED RANDOM ARRAY
10002 REM
10010 FOR I = 1 TO N
10020 G(I)=INT((I-RND(1))*10)
10030 PRINT "ELEMENT "I" VALUE "G(I)
10040 NEXT
10050 RETURN
```

guess is not a 'direct hit' the above and below numbers are accessed which eliminates some user error in cases where a name has been wrongly keyed-in and the right one could be on either side of the latest guess.

The routine is in Microsoft Basic and should therefore run on most CP/M micros. Conversion to most other dialects of Basic should only be a matter of changing the format of some statements and commands (syntax). The routine can be hived off for use on its own – the hit-or-miss part (lines 10000-10050) could be left out or user-added responses replaced.

The Binary Chop routine can be hived off for use on its own. The hit or miss part could be left out

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TELL YOUR MICRO WHAT'S WHAT

Switch on a computer and you switch on a useless machine. Unlike a car, washing machine or screwdriver, a computer isn't designed to do any particular task. And it won't do anything at all until you give it a program that you've either bought or sat down and written.

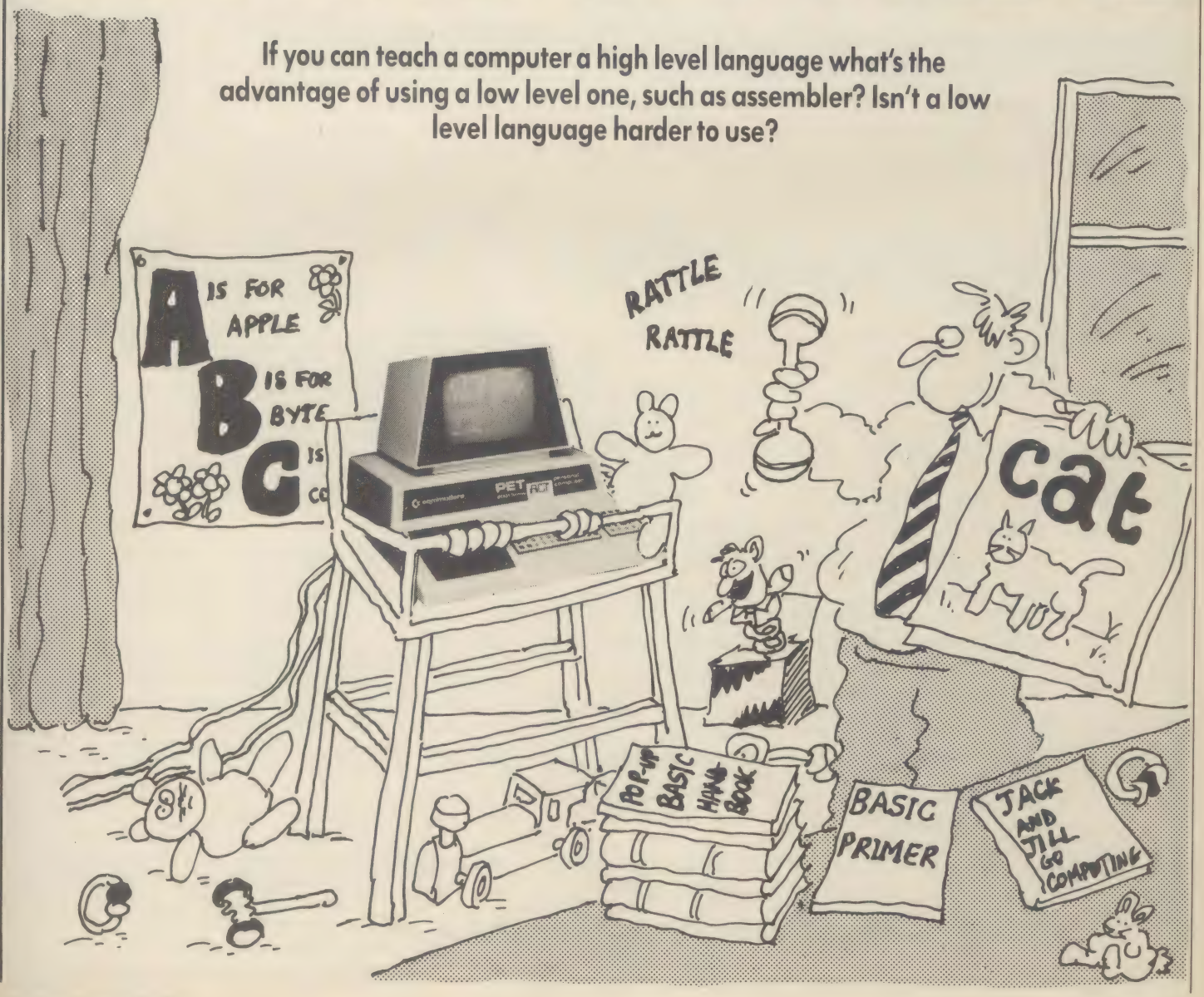
Programming a computer merely means giving it a sequence of instructions it can understand and perform. But it's no use giving the computer instructions in a language as ambiguous and idiomatic as English.

Programs must be written in languages that achieve a compromise between the English a human understands and the simple 'ons' and 'offs' an electronic machine can understand. At the highest level, a language like Basic provides a way to tell the computer what to do easily and quickly. At the lowest level, programs can be written directly in machine code, the patterns of binary 0s and 1s that are the only instructions a computer's processor can understand and execute.

Writing a program at this low level means detailing many simple instructions by entering the relevant binary codes into the computer's memory. This is a painful process and one that sane people avoid if they can. Since the computer's processor is essentially a mass of electronic switches, only a fixed number of very simple instructions can be provided. The computer gets its power not from the instructions it can understand but from the incredible speed at which its electronics can carry them out.

A high level instruction usually corresponds to many machine code instructions. This is so the programmer can use a

If you can teach a computer a high level language what's the advantage of using a low level one, such as assembler? Isn't a low level language harder to use?



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meaningful instruction without having to bother about the many operations the computer needs to go through to perform that instruction.

A high level program as it is written (the source program) must be translated into a machine code version (an object program) before the computer can understand it. This is done either once for the entire program, using a compiler, or partially, instruction-by-instruction, as the program is executed, by an interpreter.

This translation process reduces the efficiency of the program. Translation is slow, especially if it is being done as the program is executed in an interpreter system. Translation programs are bulky. Because they have to cope with all the possible expressions that might be used in a language, they never produce an object program that is as fast or as compact as the program would have been if it had been written directly in machine code.

Enter assembly languages. Sandwiched between easy-to-use high level languages and almost impossible-to-work-with machine code, assembly languages provide a convenient way of producing machine code programs. Unlike a high level language, one instruction in assembly language corresponds directly to one particular machine code instruction. The difference is that rather than have a binary number for each instruction, programmers can use a mnemonic (a short name that reminds them what the instruction does). Instead of being restricted to 'meaningless' numbers, programmers can use whatever names they want for the various data and addresses they use in the program. Instead of the lists of numbers that comprise a machine code program, assembly language allows the programmer to add comments to the program, showing what it does and how it does it.

So an assembly language is simply a way of writing machine code programs in symbolic form to make them more manageable. Just like a high level language, an assembly language source program needs to be translated to machine code before it can be run. This can be done by hand but is more often accomplished using a program called an assembler. Assemblers come in all shapes and sizes, from the simplest (which allow mnemonics for instructions but not names for numbers) to expensive fully-featured disk-based packages. Every assembler adds its own instructions to those the computer's processor will understand. These 'directives' or 'pseudo-ops' do not represent any machine code that the processor will understand but are used to guide the assembler's work. Some are used to control the assembler's features, for example telling the assembler what values the names you have used represent. Others allow you to set up any data that the program requires, for example by reserving a block of memory for the program's variables.

Compare the two pieces of program in figures 1 and 2. Both search through a list of 100 numbers and find the largest one present. One is in Basic and the other is in assembly language for the 6502 processor. Notice that the 6502 version needs more instructions and is less comprehensible, even with its comments. The 6502 listing was produced by an assembler as it performed the translation. The source program as written and entered by the programmer appears on the right. On the left, the assembler has output the object program by giving the locations in memory and the values stored there opposite each corresponding instruction in the assembly language version. The assembler has given the machine code values in hex (short for hexadecimal, a numbering system of base 16) rather than binary simply to keep the listing in a manageable form. Although the Basic version is apparently shorter, remember that once assembled, only the actual machine code will be used in running the assembler program. In contrast, Basic will need to keep the source program and the interpreter in memory during execution. The 6502 version will run perhaps hundreds of times faster than its Basic equivalent.

Although assembly language is not especially difficult to learn or use, it is a very different skill to programming in a high level language. The programmer does have to learn how the computer works and detail every little operation that takes place. This is the strange programming environment that the English-like languages were designed to avoid.

The aim of these English-like high level languages is, eventually, to take the programmer away from the machine's internals. You shouldn't have to know how the memory is organised, and how instructions are executed.

To a certain extent, that aim has been met. For example, if you want to print something, and are programming in Basic, you just tell the machine to PRINT. You don't have to tell it how to print. In assembler, you do. Because of this, you have to know far more about the machine's architecture: what's where in memory, how the processor is split up according to function, how and where to load instructions and data from the main memory (the RAM and ROM) into the processor's own memory (the registers which act as its IN and OUT trays: ready with the things it needs, and a short term store for the work it's done).

Apart from the simplistic nature of the instructions, the lack of built-in aids for testing and correcting programs in assembly language make the programmer's job that bit more difficult. This means that a disciplined approach to programming is very important. The programmer must concentrate on design and advanced planning to make programs as reliable as possible from the start. The sensible approach to a task of starting with a general statement and dividing it up into ever more detailed sub-tasks is just as important here as it is in the so-called 'structured languages' like Pascal.

Three obvious tactics are frequently

FIGURE 1

BASIC PROGRAM

```
100  REM FIND LARGEST NUMBER
110  LET B = 0
120  FOR C = 1 TO 100
130  IF N(C) > B THEN B = N(C)
140  NEXT C
150  REM B NOW = TO LARGEST VALUE
```

FIGURE 2

ASSEMBLY LANGUAGE PROGRAM

asm

```
                    1  * FIND LARGEST NUMBER
                    2  *
                    3  * SEARCHES A LIST OF 100 NUMBERS
                    4  * RETURNS THE LARGEST IN 'BIGST'
                    5  *
                    6  * FIRST, TELL THE ASSEMBLER
                    7  * WHAT 'BIGST' AND 'BASE' REFER TO
                    8  *
                    9  BIGST    EQU  100
                   10  BASE     EQU  512
                   11  *
                   12  * THE ACTUAL PROGRAM STARTS HERE
                   13  *
7000: A9 00        14  BEGIN    LDA  $00      ; SET BIGGEST TO ZERO
7002: 85 64        15          STA  BIGST
7004: A0 64        16          LDY 100; SET COUNT TO 100
7006: B9 01 00     17  LOOP     LDA  BASE,Y   ; GET NEXT NUMBER
7009: C5 64        18          CMP  BIGST    ; IS LESS THAN BIGST ?
700B: 90 02        19          BCC  LESSTHAN; IF YES, TRY NEXT
700D: 85 64        20          STA  BIGST    ; ELSE SET NEW VALUE OF BIGST
700F: 88           21  LESSTHAN DEY          ; TAKE ONE OFF THE COUNTER
7010: DO F4        22          BNE  LOOP     ; AND REPEAT IF ANY MORE TO DO
                   23  *
                   24  * BIGST NOW CONTAINS THE
                   25  * LARGEST VALUE
                   26  *
```

machine code object program **Assembly language source program**

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adopted. One is to invent, learn or steal short sequences of instructions that do the commonly needed tasks that weren't included in the processor's set of instructions. These can be automatically written out when needed in a program. The second is to rely on subroutines, groups of instructions that perform a particular task that can be 'called' from the main program. Adding a previously tested subroutine to a program provides a way of combining instructions into useful segments that can be confidently used by the rest of the program. Subroutines are thus often used like building blocks to achieve the program's overall aim. Last, besides the actual assembler, a whole variety of programs to aid program development are standard equipment for the programmer.

The cushioned environment of languages like Basic shield the programmer from the details of the machine. In assembly language, the programmer must be concerned about the way in which the program fits into the computer system. Besides the program, the computer's memory will contain other software, in particular an operating system.

On one hand, the programmer must avoid disrupting the system by, for example, trying to use the same memory as another program. On the other, the programmer will need to call on such software to handle the program's input and output. Sometimes such existing routines do not exploit a machine's potential to the full. Using assembly language, it may be possible to improve performance by adding, for example, faster disk access and better screen handling. The need to fit programs into an existing system commits a program to a particular machine. Only if a program uses an operating system such as CP/M for any machine-dependent jobs, such as operating disks, keyboards, printers and screens, will it have any degree of portability between machines. CP/M's advantage is that no matter which machine it is running on, the program sees it as an apparently identical system.

Unlike programming at a high level, assembly language has no built-in facilities for structuring and processing data. Programmers must design and implement whatever they need. This does mean they need to know the many ways in which the humble binary word can be used to store information, and that those primitive instructions can be combined to do more useful calculations. In return, they can have whatever structures they want, usually in the most economical way possible. Often several pieces of information can be packed into a single binary word compressing data from the many words needed for the same information in a high level language. Since a machine code program will include only what it needs, there is always some redundancy in a high level language that has to provide a complete range of functions for processing data, whether or not they are used.

So assembly languages are used to exploit the full potential of the computer. And wherever you look, programs will have been written using an assembler, from system software such as compilers and operating systems, via word processors and database managers to arcade games.

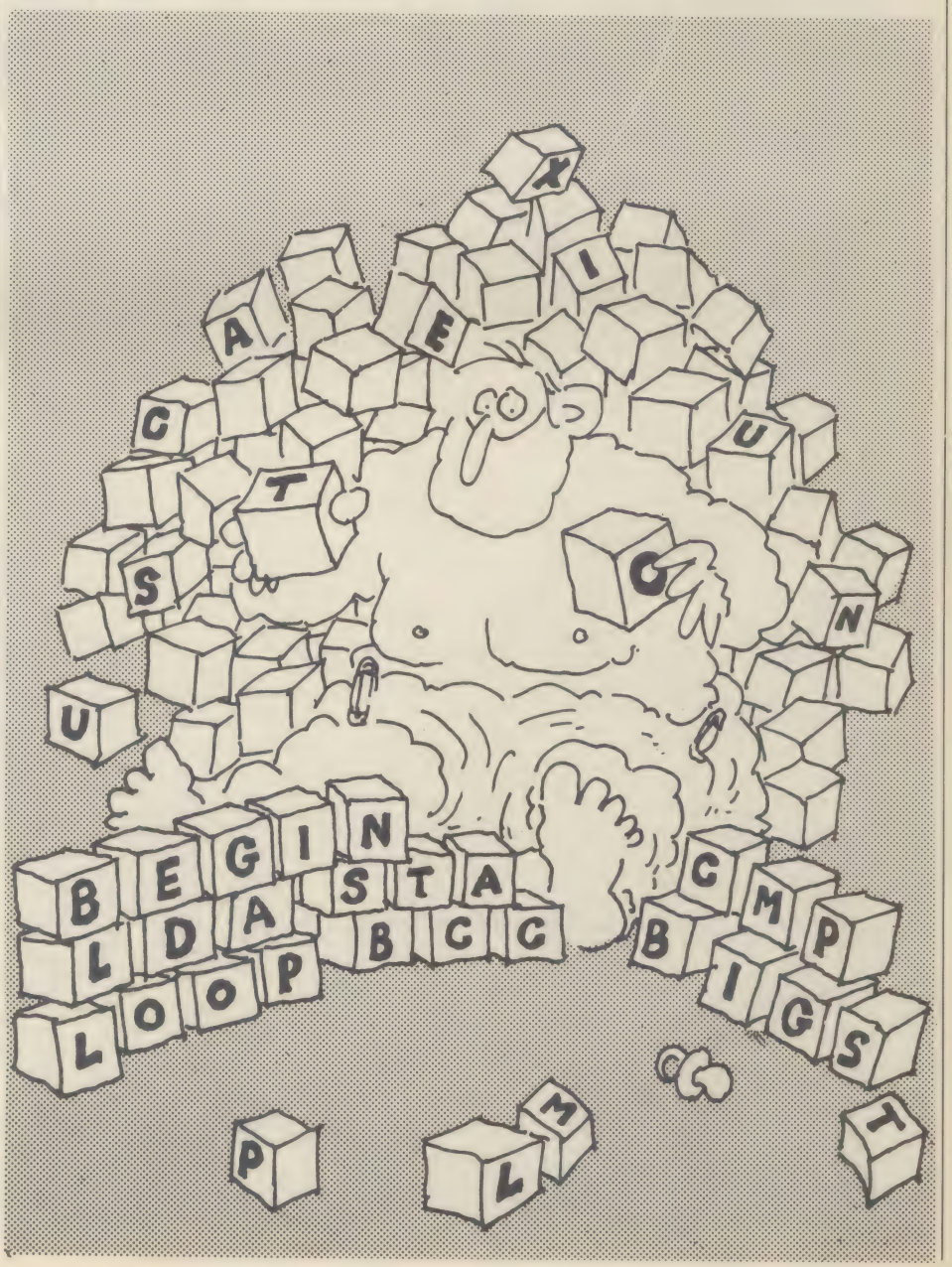
Its inherent speed is the main attraction but there is a trade-off between taking a long time to develop a fast program or using a high level language to dash off a less efficient program quickly. Often using an assembler takes away problems of speed but dramatic improvements come from changing the way a program works rather than the language it uses. As an alternative, some compiled languages (for example 'C') and some interpreted languages (for example Forth) produce surprisingly fast object programs. Before these were available, assembly language was the only way to produce programs quickly enough to communicate with peripherals and professional typists, to provide sorts and searches faster than people or to give a space invader a sporting chance of success. Even if a high level language is used for the bulk of the program, sneaking off into a short machine code routine to sort or update a display is a common trick for combining the best of both worlds.

The compactness of machine code is an obvious benefit in any system with a limited memory space. Writing ever shorter routines to do the same job is a strange obsession with many programmers. It is invariably better to use any spare memory to make a program easier to use. Anyone who has had to use some of CP/M's short, but message-less, utilities will agree. Even if you don't want to write a mind-bending word processor or a fully specified space invader game, machine code can come in handy for the odd short routine – a patch to allow your database management program to drive an unusual printer or to add a word count facility to a word processor package.

Frequently, machine code routines are used as extensions to high level languages. Routines to draw shapes, play music and mess about with textual data are often added onto those Basics that came without. Often, because a machine code program offers total control of the machine, assembly language routines that by-pass existing software can dramatically improve a machine.

Learning assembly language teaches a discipline that will be of help in other programming languages and in understanding and solving problems that occur with software and manuals. Apart from the enjoyable experience of learning it, assembly language gives you the final say in what exactly your computer is. So next time your computer is pretending to be useless, tell it what's what.

By Max Phillips, a staff writer with *What Micro?*



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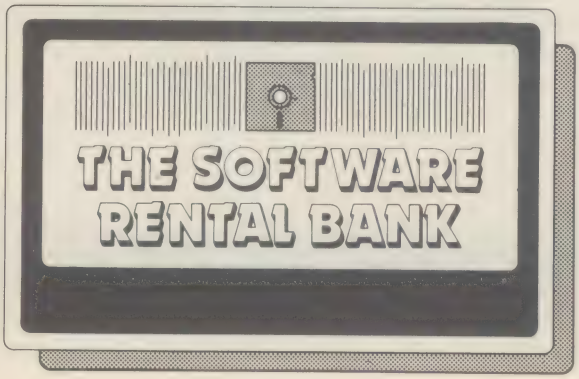

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If you have a program generator, does it mean that you can give up programming? If not, what can you stop doing? Can anyone use a program generator?

For this answer I have chosen a basic definition to distinguish program writers from database packages. The system should produce high level code, such as Basic, which can be separately run and is not dependent in any way on its generating parent. The program writing system is to the computer user what the philosopher's stone has been to the alchemist, and just as keenly pursued.

In the dim and distant past all programming was carried out by white-coated electronic experts, moving plugs and switches on valve-operated monsters. The high level languages of the '60s, such as Cobol, were supposed to introduce programming to the world. When this was not over-successful, various report generating languages were spawned, such as Filetab RPG. The boom for such systems obviously meant they had not yet found that stone.

In the late '70s micros made computer power available to a very large number of people, but programming them was no easier. In some ways it was more complex. Basic has few sophisticated methods of handling data files. Therefore the hunt was on again.

One of the inherent problems with any packages for a micro is designing it to cater for all eventualities. A package on a micro cannot be too expensive as packages must sell well to recoup the development costs. To sell in high numbers it cannot be aimed at very specific application areas as this will limit its potential market.

So the program generators should be able to generate many types of system. There is a basic concept of power versus simplicity of use in most fields. In general this means the most powerful systems are more difficult to handle, it is also true that some systems which are not very powerful, due to bad design, are difficult to manage. Before moving on, here's a definition of power, and ease of use. A high powered system would have many facilities and produce a more sophisticated end result. An easy to use system would not take long to master and not require too much knowledge to operate.

However, this trade-off is inevitable and there is no reason to decry either approach, each has its place. Specific generators may have been designed for a particular group. In

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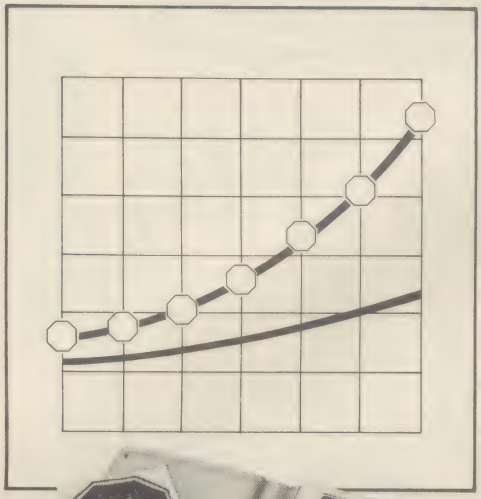

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computing the poles would be the programmer/analyst at one end and at the other the non-programmer. Their needs groups are different. The non-programmer has a grasp of what he needs to do, but not how to execute this idea, while the programmer has a thorough grounding in program file structure and file generating, but may not understand the problem in hand. The communication difficulties between two people who are expert in different fields are not unique to computing.

The complexity of the task will in many ways dictate which person is best able to tackle it, and hence which system to use. Simpler functions, such as those sometimes referred to as the electronic card index, are well within the scope of an untrained user. The design can be easily visualised and the terms file, record and field can be interpreted and assimilated painlessly. However, when the task gets more complex, requiring multiple data files linked and indexed, the end user will start to run into problems. The problem is ignorance of file handling concepts and techniques.

With this in mind, the systems aimed at the end user should cope with most of the simple file handling without much intervention. This is to say, features such as storage and retrieval should be almost automatic. At the other end, a sophisticated user should not only be able to use this key index but also have recourse to designing complex file structures, such as 'trees', if necessary.

Many systems written on micros from scratch use quite complex file structures not because of any masochistic tendencies of the author, but to get the maximum amount of information on the system. The disk storage of micros is quite small and there is rarely room for the luxury of duplicated data.

Another aspect that must be borne in mind, is that the code generated by and for the non-programmer is unlikely to be modified, whereas the code produced for the programmer may well be 'tweeked' to produce results not possible with the generator alone. This then places different emphasis on the code generated – if it is aimed at the programmer it must be well documented with remarks to make updating easier, and will probably have user-defined names.

Enough on the background – now to the systems themselves, specifically three: Nucleus, Last One, and Pearl III. These have been chosen as all have been on the market for some time and they run on CP/M, which in turn was chosen to provide a more meaningful comparison as all three could run on the same machine.

All three use menus to guide you through the facilities offered and they are quite involved and at many levels, especially with Pearl III and the Last One.

All use a tutorial example to familiarize you with the system. This is a good approach on two counts, first as it offers instruction in the use of the facilities in an easily digestable and in some cases enjoyable form; second, and in many ways the most important, it allows you to produce a working system. This achievement bolsters self-confidence and encourages progress, which is far better than allowing someone to experiment, create mistakes and become disillusioned. All generate programs, two in MBasic (interpretive) one in CBasic (compiled). All three go through the phase of producing the system parameters, defining the files, records, fields and other aspects of the system in a fairly standard computer-type fashion.

But after these similarities the systems go their separate ways. One of the most basic ways in which they differ is the point at which they generate code, and the amount of code they generate.

The Last One allows a simple 'verbal' flow chart to be developed which contains 50% of the information required, the rest, such as branch addresses to other parts of the program (for GOTO, GOSUB and so on), are defined as the program is being coded.

In Nucleus and Pearl the code generation is simply initiated and one can go off for a

cup of coffee as the computer has no further use for you.

Pearl III generates, after all the definition, a full system – a suite of programs – whereas the other two produce one program at a time. This means that once Pearl is off generating you have time to get caffeine poisoning.

The Last One, in some of the recent advertising material, was described as 'finding its most immediate use in the hands of a professional programmer, but anyone with a serious interest in computers will be able to use it with a minimum of practice'. This is true. The Last One does provide facilities for both groups. However, for the latter some gaps are found.

As is the case with many CP/M systems, a wide variety of terminals may be used, hence, a miriad of control characters are required to operate them. While the routines supplied to enter such control characters are more than adequate (in fact some produce some quite interesting images on the screen) they may well be beyond the naive user. Far better would be a terminal menu, like the Wordstar word processing package, or failing that, a dealer who could set it up. The entry of file/field details with this system is very simple, like most of its functions.

The system is in fact very flexible, one can design practically anything from complex index file handling of business systems to a glorified calculator. It is actually possible to define a program that will allow you to set up a screen, enter two numbers, multiply them together and display the result. The program produced is about 100 lines long – a bit of over-kill, as it still has to call full-scale routines even if you use only a small part of their facilities.

This flexibility has good as well as bad points. The good news is there are few constraints. However on the negative side, everything must be specified, as there is little in the way of default (meaning preset) design or structure.

This is particularly true for indexing. Simple sequential searches are of course possible, but anything more complex must be defined by the user. This is fine for an experienced programmer but not for the first-timer. It would be far better to have a default index sequential access method, for use if required.

Another double edged sword is the way the system extracts the required information. The original flow chart produced is only part of the full system specification. This is fine for the new user who will want to build up the general layout as a whole, before having to enter the fine detail. However, the expert user will have (definitely should have) designed the system in its entirety and would wish to enter it as such and leave the machine while it gets on with the job of programming.

On the documentation front, the two areas lacking sufficient depth are reporting and the whole area of pointer setting. On the bright side though, the manual is very easy to read and takes the first time user fairly painlessly through the generation of a program.

Some of the other good points of the system are screen handling and the concept of flow charting, especially the ability to make changes even after a program file generation. The screen production is simple and quite sophisticated – it even has a facility for drawing borders and so on.

The system codes from the flow chart, is not the graphic representation one is most familiar with, but an 'English-like' series of commands. Even when these have been defined, it is possible to alter them, using commands to insert, amend and delete. A copy of the flow chart can be printed out during development and also included as REM statements at the top of a program it produces. Files and flow charts can be modified after they have been used in live running. The system then generates a new flow chart and suite of programs, and alters the file structures accordingly. No matter how powerful this facility is, it should be looked upon as a last resort, and should not be used as a substitute for insufficient thought at the design stage.

Now to Nucleus from Compact Accounting. The system is different to the Last One as it is very structured indeed. The package

is aimed squarely at the systems house and competent dealer and is designed to produce a business system complete with menus, reports and input screens. ISAM (index sequential access method) and AID (amend, insert and delete) routines are automatically provided.

Once the system has been completed it can be hived off and the end user need never know it was produced using Nucleus. The file and field creation menus are followed in order with questions on field length and basic validation, nothing too complex for any analyst/programmer. No input screen layouts are provided yet, but these are in the pipeline and should be available soon. After the files have been created, the menu routine and sub-menus are automatically defined to allow insert, amend, delete and review and also all indexing. It is in reporting that the system really scores, and not only for program generation, but for other uses. The report generator will be able to link to Compact's range of business systems, so users can produce reports from the packages to their own specification. The formatted report will allow layout of invoices and so on and the word processing operation will allow, for example, data from the files to be incorporated in a word processed document. Operating the report layout is quite simple, you set up the headings and select the file that you require using logical connections such as and, or, not and so on and the fields required are then defined. The machine checks there is sufficient space. You then run, test, print, insert spaces and edit the report screen layout to produce the format to your liking. Sub-totalling, grand totals, as well as page breaks, are all possible. This report option is then named and inserted into the reports menu, and you have a working system.

The last, but not the least, is Pearl III. This, again, is aimed at the knowledgeable user. Like Nucleus, the goal is a suite of business programs. The facilities offered are probably the most extensive of the three, and it will probably take longer to master. One experienced user told me that the first program he wrote took him twice as long using Pearl, as it would have done using normal Basic. Now he is an expert he can produce system five times quicker than by using conventional programming.

The main menu is so large and comprehensive that it strikes a little fear even into the heart of a trained user, on the first viewing. However, the system makes sense once you work your way through. The file naming is comprehensive and there is a high standard of validation, at a level more common in mainframes than in micros. Not only is the user given indexing as an option, but there are three other types of file. The system even allows you to define the full variable name and move subroutine bases required. These facilities are very useful in modifying the general program. Report definitions are wide ranging and flexible but complex. Once the system is defined, various validation reports are run and all errors notified. If there are none, the programs can then be generated, the whole suite is produced with no user intervention. However, the system produced is only an intermediary, it must then be compiled for running.

The level of detail of reports produced by each system varies according to the type of user group that they are aimed for. Pearl produces masses, almost enough to document the finished product. The Last One produces least. The same is true of the internal documentation of the programs themselves. The size of the system's manual also reflects the complexity involved.

As a general rule all these systems still work best with an accurate system design, even going as far as producing report and screen layouts. The user who has not gone to this length will probably generate an inefficient system or waste much time in front of the terminal head scratching.

The Last One, however, is the kindest of them all to the user who changes his mind. It is capable of running a large number of programs, and is simple for non-professionals, although they may stumble over file handling for a while. Nucleus is ideal for the system designer with an analyst type outlook. It will provide an ideal medium for a highly structured approach. Pearl is a powerful programmer/analyst type tool which will be most at home with a very experienced person who expects (and will get) a high degree of mainframe-like validation and error checking. The prices Last One £260; Nucleus £999; Pearl III £250.

By Eric Bagshaw, senior consultant, Microsystems Centre.

* The NCC is conducting a survey on program generators, which is due out in six months time.

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Q&A

SORTING OUT THE BUGS

Why is it that some micros have problems calculating simple sums? I understand that the IBM Personal Computer can't even divide properly. If I bought one could I iron out the software bugs myself?

You could say that mathematics on computers are fundamentally flawed. The reason is that computers use two numbering systems: decimal and binary.

One result of this is a problem that has emerged in the Basic programming language produced by American software house, Microsoft, for the IBM Personal Computer and the Sirius.

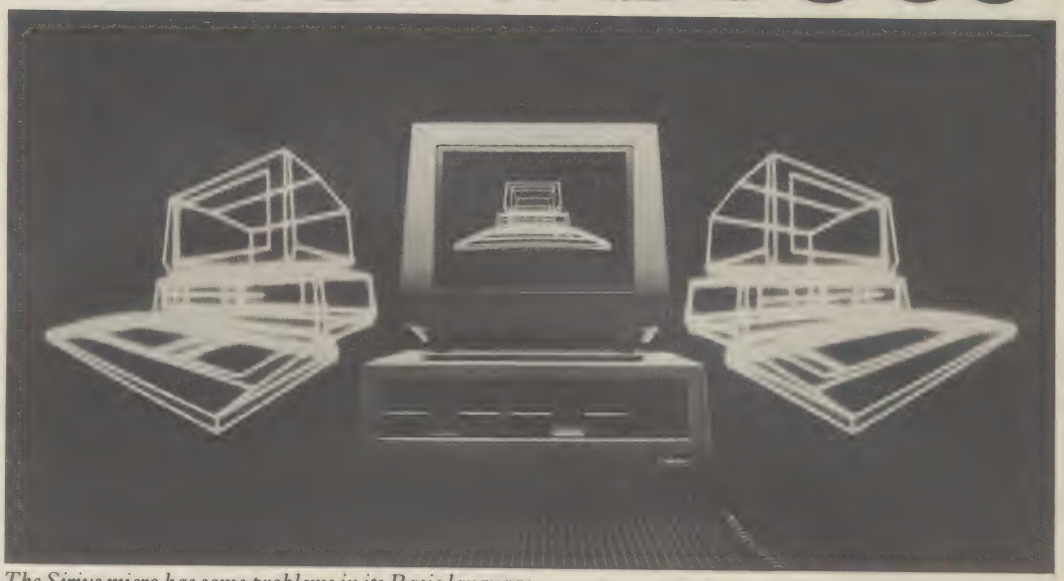
If you are running Basic on either machine, you will find that it apparently cannot work out a simple sum correctly. Ask it to multiply 0.6 by 100 and the answer you will get is 60.00001. Quick mental arithmetic will tell you that this is out by a factor of 0.00001. Worse than this, the error occurs with much larger numbers, which yield correspondingly larger errors. For example, 981 divided by 100 and then multiplied by 100 yields the result 981.0001.

To understand this error, first consider the two numbering systems used by a computer. Binary is just like decimal, except that it operates to base 2 rather than base 10. The figure 10 in binary represents the number 2 in decimal. Binary 100 is decimal 4.

This conversion from decimal into binary, which you use to enter numerical values into the computer, is not always easy. If you have ever tried to divide one by three, you will have run into a problem: the result is a recurring number which produces a series of threes that will go into infinity. The same problem occurs in binary, only not with the same numbers.

For example, divide six by 10, and the answer is 0.6. Convert 10 and six into binary and do the same sum and you get a recurring binary number. So, when the computer is asked to perform a calculation on 0.6, it has to use the recurring binary number.

The traditional method of coping with recurring numbers, given that there is no way of writing down or storing an infinite series of numbers, is to round off the last digit you've got. If you are working to five decimal places, the way of representing, say, 0.66666... is 0.66667. The last decimal place is rounded up as it is over five, the decimal half way house.



The Sirius micro has some problems in its Basic language

The IBM Personal Computer. It may add up, but does it divide?

When a computer stores a number, it usually stores it to greater numerical precisions than the number you will see on the screen. For example, under Basic on an 8-bit system like the BBC Microcomputer, the processor stores the mantissa (in a number like 9×10^5, nine is the mantissa and five is the exponent) in a 32-bit space. In other words it could store a binary number with 32 significant figures: you can store a number with up to 32 figures before rounding up or down is necessary.

The Basic developed by Microsoft for the powerful 16-bit 8088 processor of the Sirius and IBM PC has space for only about 21 significant (binary) figures, though you can get greater accuracy by using the double precision mathematics option offered by Basic. In decimal terms, 21 binary number precision is equivalent to seven decimal number precision. Because the results printed on the screen are to the same precision as the numbers stored in the memory, stray figures like the 0.00001 turn up as a result of recurring binary numbers being rounded up or down.

So the error in the 16-bit Basic results from having lower precision than many 8-bit Basics. But no matter how precise a computer might be, if it stores numbers in the usual way, there will always be a certain degree of error, as all recurring numbers have to be rounded off.

One way out of this problem is to store numbers like 0.6 as fractions (6/10). For example, this bypasses problems with the constant pi, which represents the ratio of a circle's diameter to its circumference. Try to work it out using decimals, and you set a row of numbers after the decimal point as long as you want it to be. Use fractions and it's plain and simple 22/7.

Numbers seem to cause a lot of problems in computing. Clive Sinclair's ZX81 was incapable of working out the square root of one. This was less to do with mathematics than with malmanufactured chips from Ferranti.

With all this imprecision, you would be unwise to program a missile guidance system in single precision 16-bit Microsoft Basic.

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Q&A

THE MEANING OF DIM

What is the Basic DIM statement meant to do? I can't figure out its function. Is it used to set up arrays in some way?

DIM, short for "dimension", is an instruction that has always been necessary to Basic but whost exact meaning will vary slightly depending on which computer you use. Its job is simply to warn the computer how much data you are going to use so that it can set aside an appropriate space in its memory before you actually start using the data.

If a theatre box office has just sold seat number 10 and a party of 20 makes a booking, the box office would reserve a block of 20 seats and continue selling with the next free seat, number 30. Similarly, although Basic is quite happy for you to create new variables when you need them, simply by writing LET X=4 or LET A=2100 and so on, it will have problems if a party of 20 related numbers turns up unannounced on its doorstep.

On older computers, DIFM is often used to tell Basic how much space is going to be used for storing text by stating how long any string variables (variables that contain strings of letter or numbers) that are used need to be. So DIM A$(50) would let you have up to 50 characters sin A$. Most Basics now automatically reserve up to 255 characters in every string used. So DIM is rarely used in this sense.

Instead, DIM is used to create arrays, lists of either numbers or words. DIM A(10) would create a list of 10 numbers called A(1), A(2), A(3) and so on up to A(10). Similarly, 200 names could be stored in an array of strings after the statement DIM N$(200) has been executed. Arrays do more than just create masses of variables. Any particular value in the array (an element) can be referenced by any numerical expression in the brackets after the array name (the subscript). So to print out the 10 numbers in array A we could write:

```
50 FOR P=1 TO 10
60 PRINT A(P)
70 NEXT P
```

or to print out the 200 names in four columns,

```
50 FOR P= 1 TO 200 STEP 4
60 PRINT N$(I), N$(I+1), N$(I+2), N$(I+3)
70 NEXT P
```

Anywhere a group of related items has to be processed, for example sorting or searching, arrays will be used. So far the examples have referred only to lists, arrays having one subscript.

Arrays having more than this one 'dimension' are frequently used, both in computing and in the real world. A timetable is a two-dimensional array, often called a table or matrix. The two dimensions might be row (the station names) and column (the departure times). If we wanted to create a table of names and sexes on the computer, we could use DIM T$(10,2). The table could be visualised like this:

T$(R,C)	name	sex
entry 1	Mark	boy
entry 2	Susan	girl
entry 3	John	boy
entry 4	Mary	girl
		etc.

Each row is the entry for a different person and the two columns are for name and sex. To refer to a particular element of the array, we need only write T$(R,C) where R is the row and C is the column desired. It doesn't really matter which way round these are so long as you stick to the same order throughout a program. What can be done with T$? An example is to print out all the girls. We need to look down column 2 and whenever we find "girl", we should print the corresponding name (which is in column 1 of that row):

```
100 PRINT "Here are the girls..."
110 FOR R = 1 TO 10
120 IF T$(R,2)="GIRL" THEN PRINT T$(R,1)
130 NEXT R
```

Using more than two dimensions is possible on many Basics. For example, DIM A(4,4,4,4) creates a four dimensional array that, despite being reasonable for the computer to think about, is quite a difficult thing to visualise.

Using arrays requires care and planning. You must ensure that subscripts are never negative or greater than the value given by DIM. Many Basics, incidentally, allow you to use a subscript of zero, giving you one more element than you ask for. In this case, DIM A(10) creates an 11 element array from A(0) to A(10).

One hint is not to use numbers literally in controlling arrays. Instead of saying DIM A(20) use LET N=20 then DIM A(N). All your loops and tests should look at the value of N and not at 20. This means that if you run out of memory or decide to alter the size of the array, you need only change the one LET statement rather than a lot of instructions.

Once you've DIMensioned an array, you can't normally change its size. Imagine the problems if the party of 20 turned out to be a party of 30. Some Basics have an ERASE instruction which allows the computer to forget an existing array and reset its demensions. If yours hasn't, the best you can do is DIMension arrays to the largest size needed and if necessary only use part of the array for some of the time.

Arrays or DIM instructions are not especially difficult to use. With some experimentation, it should become obvious why they are such a fundamental part of computing.

SOLID STRUCTURE

Some versions of Basic are described as being "structured", for example the BBC Microcomputer Basic. How does this differ from other versions? Is it a real advantage to have a structured language, and if so, what are the advantages?

There is a small growing sect in professional computing, whose members follow a religion called structured programming.

The structuralists, as we shall call them, are very rude about languages like Basic. They say these languages encourage sloppy structures. Structured programming is a method developed to improve programming practices. It aims to ensure that programs display a logical structure, so they are easier to understand and maintain.

Languages like Pascal have features built in to make structured programming easier. For example, in Pascal all information about variables (except their values) is given at the beginning of the program. A list is used, giving the name X,Y,Z, NAME etc) of the variable and the type (whether its value will be an integer number or not, or a string of characters).

The advantage of this approach is it makes it easier to keep track on the use of variables, and encourage people to think about the variables they need before launching into programming.

This type of facility, on Pascal, is not available with Basic. But there are other structured facilities which have been introduced to versions of Basic to ease the headache of sorting out the logic of a program.

One such facility, available with the Basic used on the BBC Microcomputer, has the following syntax: IF X THEN Y ELSE Z. This acts as a branching mechanism. Here X might be A = 10. If A is equal to 10, then one set of statements is executed (in the above example called Y), if A isn't equal to 10, then another set is executed (Z).

Other structured facilities available on some versions of Basic include REPEAT ... UNTIL and WHILE ... WEND. Both are used to set up loops, and complement the standard Basic facility, FOR ... NEXT. One shortcoming for FOR ... NEXT is that it entails specifying the number of times the loop is executed. For example:

```
FOR X.= 1 TO 1000
NEXT X
```

This, and any statements that may occur inbetween, will execute 1000 times. However, with REPEAT ... UNTIL, the loop will execute for as long as it takes to reach a certain condition. This can be done without the REPEAT facility, using IF ... THEN:

```
10 LET X = X + 1
20 IF X < 1000 THEN GOTO 10
```

The main advantage of REPEAT is one of speed. With a GOTO statement the whole program is scanned all the way through until the relevant line is reached. With REPEAT, the program immediately returns to the relevant REPEAT statement. Structuralists would say it's nea-

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Q&A

ter not to have the GOTO, but that's a matter for dispute.

WHILE ... WEND differs from other loop statements, it doesn't assume that a loop needs to be performed. With REPEAT at least one pass will be made before the program jumps onto the next step. With WHILE ... WEND the program will make the jump before the loop if a particular condition isn't met. For example:

```
100 WHILE X = 10
200 LET Y = X + 1
300 WEND
```

If X doesn't equal 10 the program will ignore line 200 and carry on with subsequent lines. One further point about the use of REPEAT ... UNTIL, as compared with FOR ... NEXT; sometimes you might use an IF ... THEN statement after the FOR in order to jump on when a condition is met, as in:

```
1000 FOR X = 1 TO 1000
2000 LET Y = 10 * X
3000 IF Z = Y THEN GOTO 5000
4000 NEXT X
```

This is an undramatic but classic example of what structured programming tries to avoid. The problem is that should this procedure be more complex (for example, by involving more variables), changes made elsewhere in the program could bring the whole structure tumbling down, and it would be very difficult to find out why.

The reason for this is the heavy reliance on the structuralists' bug-bear, the GOTO. The inventor of Pascal, Niklaus Wirth, so hated the GOTO he left it out of his original specification of the language. Other people put it in later. Though many would agree that total exclusion of the GOTO is going a little too far, the structuralist principle is a useful one to remember: avoid interdependence between different parts of a program.

The Basic subroutine is structuralist curse, because it breaks that principle. Not only does it use a form of GOTO (GOSUB), but it's usually at the end of the program, where it doesn't logically belong.

It has some other disadvantages, the most notable being that you can't pass data to it. For example, suppose you had a subroutine that drew a circle, you could not include in the GOSUB statement details about the dimensions of the circle.

The way round this one is with two programming entities that are music to the structuralists' ears (also available on BBC Basic). They are function and procedure. In structured languages these can be treated as discrete entities.

The difference between them is simple: a procedure does something (like draw a circle) whilst a function returns a value. Functions can also do things like draw circles (and return some value, which can be used to report that the circle won't fit on the screen), but procedures cannot return a value.

What you can do with both is pass data to them. Suppose, for example, you wanted to have a procedure to draw a circle. You would use the following syntax:

```
10 DEF PROC CIRCLE (X,Y,R)
20 ... 90
100 ENDPROC
```

Here lines 20 to 90 contain the statements needed to draw to circle. The variables X,Y and R in line 10 are used in the procedure to represent the position of the centre of the circle (X,Y) and the circle's radius (R).

The procedure is then placed at a position in the program where it will not be executed (for example at the beginning, with a GOTO statement just before so the program jumps over the procedure). This is structurally permissable because the procedure is a discrete unit.

Then, when you want to draw a circle, you simply call the procedure using the statement PROC CIRCLE followed by the X,Y coordinates and the radius. The syntax for a function in BBC Basic is almost identical, except FN is used instead of PROC.

One of the least structured things about Basic is the way variables are used. As well as not being declared at the beginning of a program, they are global – they are significant throughout the program. So, once the variable X is used, it cannot be used in another context elsewhere, even in a subroutine. Again, the sign of a structured Basic is the facility for local variables, which only apply to a part of a program, like a procedure.

Structuralism is more a way of thinking than a set of facilities. But when these sorts of commands are available, they tend to enhance Basic programming.

It draws us away from the temptation to write programs as we type them in, and is an inheritance of a world of computing where you can't try things out instantly simply by typing the command RUN.

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Q&A

DISPLAY THIS WAY

How do I make Basic programs look neat and well presented on the screen? Are there any simple tips or routines to sort out the mess I make?

Producing neat displays, despite being a vital part of good programming, is not something Basic is very good at. It takes some hard work, and a sizeable portion of a program, to get good results. Many commands have been added to Basic to make life easier but these vary for each machine. So usually a neatly-presented program cannot easily be moved from one machine to another.

Two things to aim for are clarity and consistency. Clear the screen regularly and present only current and relevant information. Make all a program's displays consistent by allocating certain parts of the screen for titles, error reports, data entry and so on. This is easier if you use a standard set of routines for all display and entry work for the whole program. Write a routine to print titles, one to print error messages and so on. Centre titles by using a statement such as:-

```
50 T$="THIS IS A TITLE": PRINT TAB ((40-LEN(T$))/2); T$
```

This works for a 40-column screen, change the "40" if yours is different. Words should never be split at the ends of lines. A Basic routine to avoid this could be written, but for most applications it may be too slow. A quick-and-dirty solution starts by typing the line number followed by PRINT ".

Using this method, you take the column occupied by the inverted commas as the left hand margin of the text. So if you enter text which runs over more than one line, check that none of the words in the second and following lines cross the inverted comma column. If they do, they will be split when you come to print the text. In order to avoid this, delete the offending word, and enter spaces until the cursor is one space to the right of the inverted comma column, and then retype the word and carry on entering the text.

```
1
24
407
3
78
```

doesn't look right. Instead, it's better to have the units, tens and hundreds digits lined up:

```
  1
 24
407
  3
 78
```

Some Basics have commands such as PRINT USING which make this easy. Others need a bit of work. Suppose we want to print a column of positive whole numbers so the units digit appears in column number 10 of the screen. If the number, let's say in the variable X, is one digit long, we need to start printing in column 10. If X is two digits long, we should start in column 9 and so on. So we need to tab to 11 minus the number of digits in X. One way to count the number of digits is to use LEN(STR$(X)). STR$ makes X into a row of characters and then LEN counts how many there are. Be careful as some Basics add spaces when you use STR$.

This method should yield a statement that reads like this:

```
100 PRINT TAB (11-LEN (STR$(X))); X
```

A more mathematical method, using logarithms, would give a completed statement as:

```
100 PRINT TAB (11-INT (LOG(X)));X
```

Here the statement returns the logarithm of X, knocks off everything to the right of the decimal point to make it an integer, and uses this to calculate the tab. But before using this one, make sure that your LOG statement doesn't return a natural log, rather a common log that works to base 10.

When preparing the screen, it is a good idea to sketch out your ideas first on a grid sheet.

STRINGS WITHIN STRINGS

How do I get Basic to look through a string to see if it contains another smaller one? For example, finding all the Smiths in a list of names

Searching for a small string within another is known as a sub-string search. Check that your Basic does not include an INSTR or similar command to do this. If it doesn't, this short routine can be easily adapted (and hopefully speeded up) for most Basics.

```
1000 P=1
1010 IF P+LEN(K$) >LEN (S$) +
   THEN P=0: RETURN
1020 IF MID$ (S$, P, LEN (K$)) <>
   K$ THEN P=P+1: GOTO 1010
1030 RETURN
```

To use the routine set S$ to the string to be searched, K$ to the sub string to search for, and then GOSUB 1000. If you want to start the search at a particular character position in S$ set the value of P to that character number and then GOSUB 1010. The subroutine will return with P=0 if S$ does not contain K$ at all. Or it will return with P set to the number of the character where K$ first occurs in S$. Be careful if the strings contain a mix of upper and lower case, as the computer views 'a' and 'A' as different characters.

THE BASIC ALTERNATIVES

I want to buy a micro that uses the CP/M operating system. Should I opt for one that has MBasic or one with CBasic? What's the difference between the two?

There are many dialects of Basic. One of the most widely used is MBasic. The dialects used on machines like the Apple are based around MBasic.

The essential difference between CBasic and the MBasic which would be supplied with, say, an Osborne, is that the former is compiled and the latter interpreted. All the Basics used on smaller micros, for example the ZX81, are interpretive.

The difference boils down to the way the machine translates the Basic statements you type (the source code) into the language used by the microprocessor (the object code).

With an interpretive Basic, like MBasic, a program called an interpreter takes each statement (for example "10 PRINT 2 + 3") at a time, translates it into object code, and then processes it.

With a compiled Basic, like CBasic, a program called a compiler takes the complete Basic program, translates it into object code, and stores it in memory ready for processing.

The advantage of interpretive Basic is that you can run a program immediately and see what happens.

But there is a disadvantage. A compiled Basic translation process only takes place once, though you have to wait around for the compiler to do its work. Thereafter, the program is stored as object code. With an interpreter, translation occurs every time the program is run. As the translation process is, by compiler standards, quite a lengthy one, running a compiled program can be quicker.

One further disadvantage with most compilers: they're complicated. You can't simply issue a command like "COMPILE" and leave the machine to get on with it. Usually the compiler includes a library of programs, called routines, which are held in object code form.

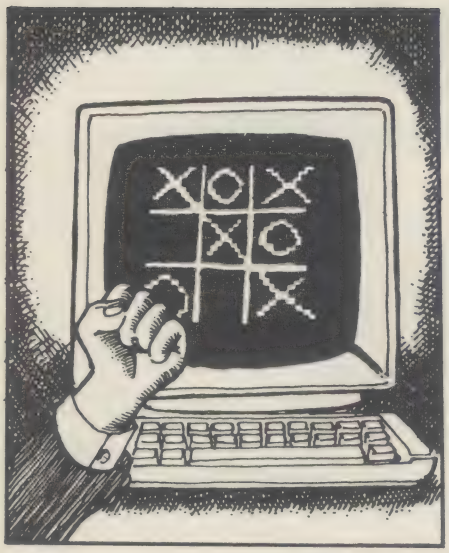
When the program is compiled, the compiler looks through the source code to see which functions are used, and pulls out from the library the appropriate object code to perform that function. It then links all these to the complete program. To compile a program, you sometimes have to exchange the disk drive, depending on whether there's room on the disk.

If the sort of programs you are going to write are likely to be used occasionally, and timing isn't crucial, it is unlikely you will need a compiled Basic. If it's speed you want, and if the program is regularly used, a compiler might be a good idea.

One point worth considering, is to get both an interpreter and a compiler.

The advantage of getting both interpreter and compiler comes when you want to test a program to see if it works. When you have written your MBasic program, you can run it using the interpreter. If it doesn't work, it is comparatively easy to make the appropriate changes and then run another test.

Occasionally a program written for the interpreter won't run with the compiler, so some rewriting might be required.



Micros can't cook breakfast (yet), but they are by nature very adaptable. This section explores possible applications (in this issue communications, databases and graphics), and suggests which of the ever increasing number of possibilities may prove useful.

You are able to assimilate written information at a rate of 1,200 words a minute. If that information comes in the form of pictures, the rate leaps up to the equivalent of 40 million words a minute.

At that rate, a picture paints 33,333.33 recurring words.

These are the findings of computer company Hewlett-Packard, from the study it conducted to aid its sales of graphics equipment and software. It shows that graphics are vital to computing, and most micro users will want to grapple with them.

The graphics facilities offered on micros are often far more sophisticated than those found on Albert Hall-sized mainframes, principally because of games. But their applications extend into all areas.

Here, four users explore the use of graphics, Suzanne Hall outlines some of the basics, Mark Soden looks at how add-on circuitry can make prettier pictures, Roy Leith reviews software aimed at making graphics easier to manipulate, and Richard Monkhouse examines a new graphics board.

GRAPPLING

But first Suzanne Hall, who runs Bespoke Micro Systems in Kidderminster, explains some of the basics of microcomputer graphics.

Microcomputer graphics are all about drawing pictures, usually on a TV screen or display. Pictures can vary from graphs and bar charts, through animated displays to a colour representation of Marilyn Monroe in the nude – but perhaps that is a bit ambitious to start with.

The first buzz-word the graphics enthusiast comes across is the pixel. This is the basic building block – the smallest picture element that you can manipulate on the screen. For displaying ordinary characters the pixel is a rectangular block which contains a single letter or number and you can put 40 (or perhaps 80 depending on your microcomputer) across the screen and usually 25 down. A 40 by 25 screen gives you 1,000 pixels.

If you examine each letter closely you will notice that it is made up of dots: each character being built up on a matrix of, typically, 8 by 8 dots. If the computer allows you to control any one of these 64 dots, the dot is then the pixel and you have a choice of 64,000 pixels on your screen. This is known as high resolution graphics.

There are several means of building a graphics picture. Some micros or add-ons give you the ability to draw a line from any one point on the screen to any other with a command like plot 0,0 to 319,199 which would draw a diagonal between those coordinates.

Graph plotting becomes incredibly easy so you can draw your biorhythm chart or the ups and downs of the stock market. But that is quite a long way from Marilyn Monroe, and to draw even a simple picture you will need graph paper with the axes appropriately numbered and quite a lot of practice.

Some other manufacturers stick with the large pixels but provide ready-built shapes that can be displayed like any other character. These usually include vertical and horizontal lines of different thickness, diagonal lines, chequered squares, circles, large dots and the shapes of playing card suites.

Using these elements you can create little animated figures, bouncing balls or space invaders which, with spaces displayed after them to obliterate their former position, can be moved about the screen at will.

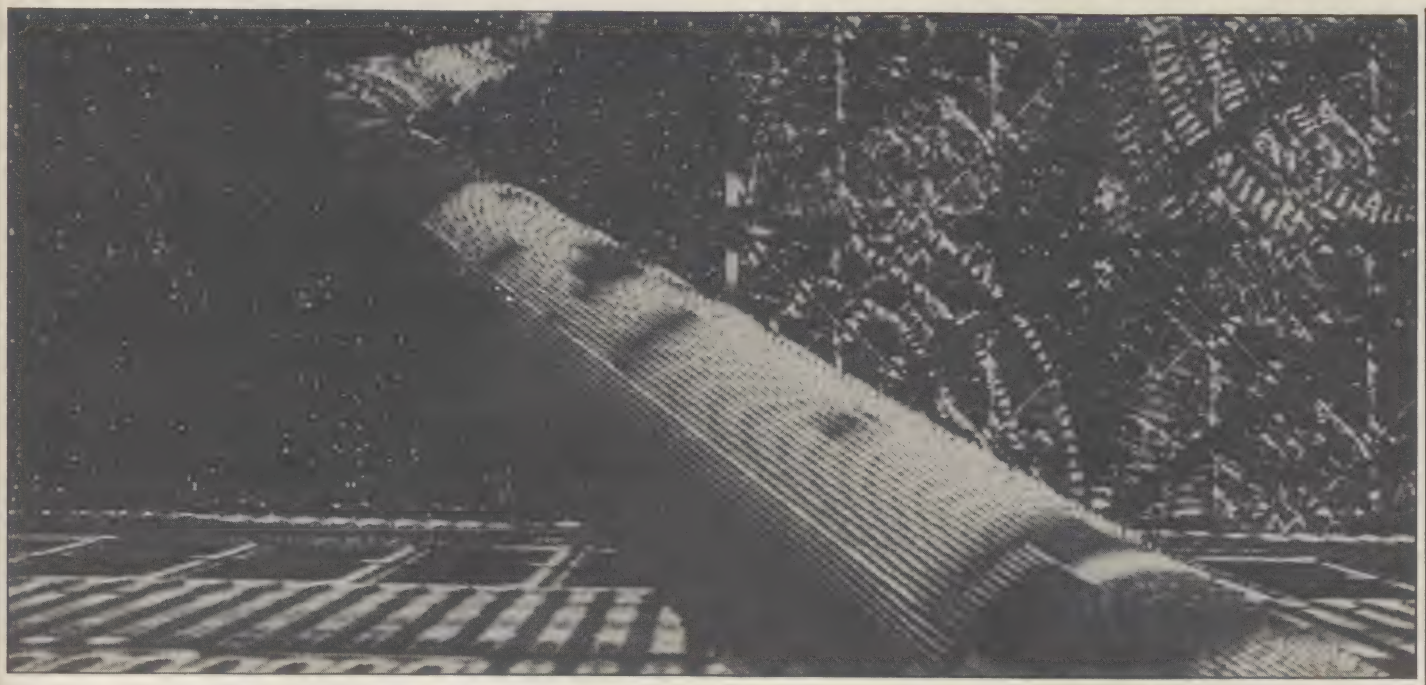
Most microcomputers will allow you only to display one character on each space, but some will let you have two displays visible at the same time, one on top of the other. You can have a background screen and move characters over this, or use the second screen to build up more complex shapes. This system opens up a whole new world of possibilities.

Extra facilities are often provided in high resolution graphics because it is not so easy to build complex designs with lots of straight lines. You may be able to define special characters, label graph axes or produce different sizes of lettering. It seems that your own imagination is the greatest limiting factor, on all but the simplest graphics systems.

Mark Soden looks at the graphics capabilities of the 380Z microcomputer from Research Machines. He uses the company's high resolution graphics system which has a special microprocessor board fitted into the machine.

The high resolution graphics on the 380Z may not be as good as a quality graphics terminal but should be good enough for most applications.

The graphics board has 16Kbytes of memory and can operate in two modes: medium resolution and high resolution. Medium resolution displays 160 by 96 points on the screen (pixels), but allows 15 shades of



WITH GRAPHICS

intensity and several 'views', or prepared screens, to be held in memory. The high resolution option displays 319 by 192 pixels, but has only four levels of intensity, and one 'view'.

The standard board is black and white but a colour board is now available as an extra.

The high resolution graphics can be used alongside the low resolution graphics which come standard with the machine. The two may also be superimposed on the screen by using two separate memory stores, and likewise, one or the other can be left unused.

The high resolution option occupies all but the bottom two lines of the screen. This allows a mixed screen to be used, with scrolling text in the bottom two lines and high resolution graphics across the rest.

This option may be used with a variety of programming languages including Assembler, Algol, Fortran and Basic. The three major commands in the graphics system are:

Resolution – basically an initialisation routine.

Plot – which produces a point of light of given intensity at the specified coordinates.

Line – draws a line from where you are on the screen to a position determined by given coordinates. This is usually used after a Plot command or another Line command.

The 380Z has a fairly comprehensive set of functions, enough to satisfy most users including the ability to hold images, pass them from the memory on the graphics board to normal user memory and then save them on disk; allowing an image to be built up before it is displayed. This avoids the relatively slow generation process being shown on the screen. Other functions include fading in and out of the display, and in

The GC1000 from Poulter Compuvision: a micro dedicated to graphics

An example of the type of games graphics available with Prestel

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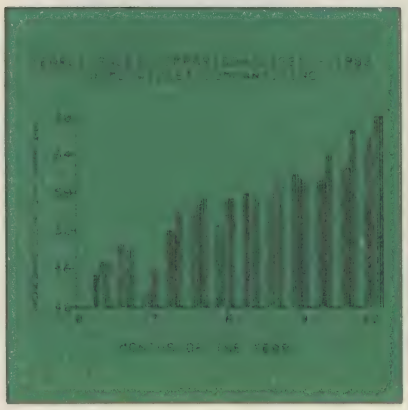

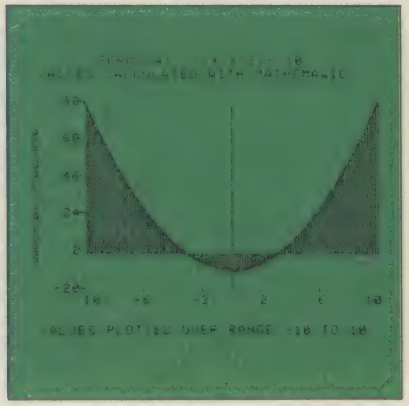

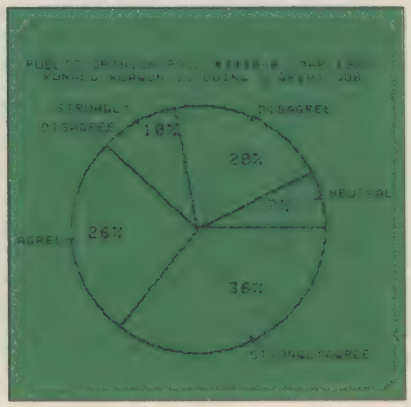

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GRAPHMAGIC – limited only by user imagination.

Ring Round 5311

medium resolution different 'views' may be held and when screened in sequence may give the appearance of rotation.

One particularly useful function is Fill, which allows a rectangular block to be shaded to a certain intensity by giving the bottom left hand corner coordinate and the top right one.

The system performs well in practice. One would have to spend a lot more for any significant improvement.

It is not particularly easy to use but then nor are most graphics systems and the first-time user has as much chance as the experienced professional.

The documentation is fair and a great deal better than the standard 380Z documentation, most of which is appalling. The graphics user guide gives examples and hints on the use of the system, and the introduction is quite good. It falls down after this because it becomes a bit vague and seems to lose track of what it is trying to say. It neglects to mention that a different version of Basic may need to be loaded to use it and this causes a great deal of initial confusion.

The system on the whole is quite good at its job and it has some nice touches – the Fill command, the separate memory which allows the split screen, and the ability to fade in and out, so that you can build the display out of sight of the viewer. However, it could be improved by having the colour board as standard and not yet another separate purchase and by being able to window in or zoom in on a particular part of the virtual image.

Atari it is aimed at the businessman, student or design engineer but has a wide range of uses. The graphics functions that the software uses is standard on all the 400 and 800 models in the UK.

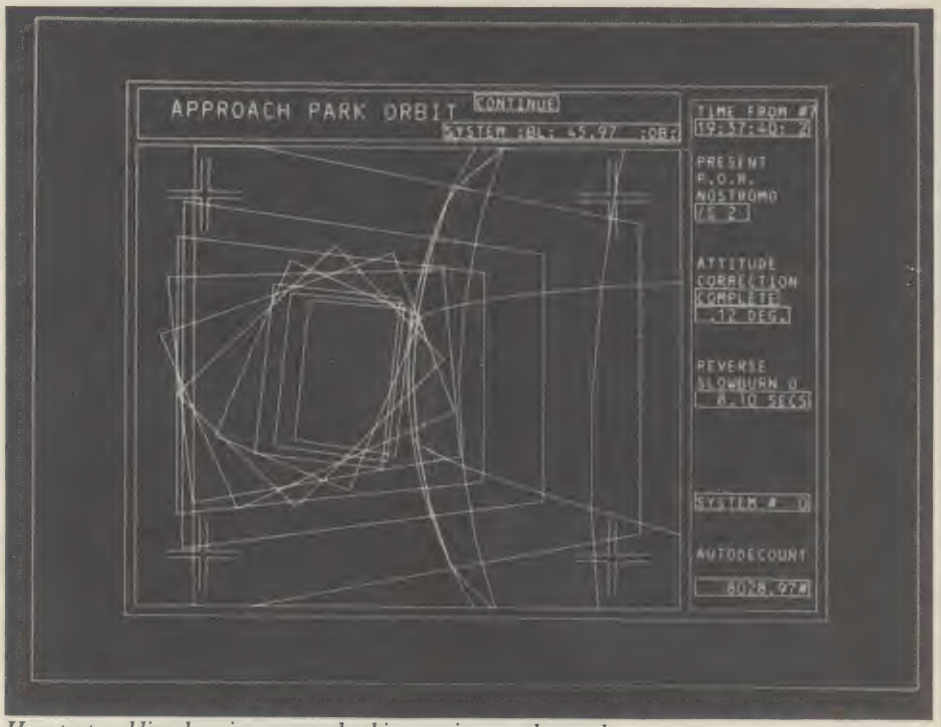
The machines use a standard TV for a display and have 14 different modes of operations ranging from text to fancy graphics characters. There are 16 colours and eight intensity shades.

The Graph It package uses a split screen with four lines of separately scrolling text.

A commercial package usually needs to meet two general requirements. First, to display business or statistical information in a way that indicates trends or proportions; and second to display mathematical plots. The Atari Graph It package achieves the first objective by forming bar or pie charts of the data input from the keyboard, and the second by displaying two and three dimensional pictures.

The bar charts are provided with headings, a numbered scale on the Y axis, and three character labels on the X axis which can be used as numerical scales. Each bar can be subdivided into three coloured bands. The pie charts are provided with a heading and a label at the base. Each sector of the pie is separately labelled and the percentage of the pie represented by each sector is printed alongside. The graphical plots are given in a chosen resolution and an (optional) Atari joystick can be used to reach each point on the screen.

The program suffers three limitations which reduce its value. The first is an understandable lack of speed in the more complicated plots. This may partly be because it uses the Basic programming language to do the calculations. Second, there is



How text and line drawings can make things easier to understand

A Centronics printer produces hard copy

no provision for entering or saving the graphics data and commands on tape or disk.

Third, there is no provision for saving the displays produced on tape, disk or printer to allow for quick display of results on demand. This means that you cannot impress the boss with a fast full colour display of your sales record, nor can you save a set of results generated in a plotting session.

The simpler two-dimensional plots are usually completed in a minute or two. Typical three-dimensional plots take from a minute for the simplest to about 30 minutes for more complex equations. Very complex plots can take hours.

These functions can employ all of the mathematical features available in Atari's 8 Kbyte Basic cartridge.

Maximum and minimum values are chosen for each of the axes, but the intervals are selected by the program. This can lead to displays, more complicated taking more time than is wanted.

This package is easy to use and also once into the program, each step is driven by a separate menu. The commands and data input from the keyboard are also printed with the menu. If a mistake is made, however, it is not usually easy to make alterations without beginning again at the starting menu.

Also, the formulae entered at the beginning of the plotting procedure are not displayed after the plot is completed. Since a three-dimensional plot may have taken several hours to complete, this may be of considerable concern. The origianl equations can be reviewed, but only after the displayed plot has been lost.

So long as the equations being investigated are noted separately, there is little chance of making errors since the program gives clear instructions with each menu and gives one a second chance if an invalid input is keyed in.

The handbook that comes with the program is colourful and well laid out. It starts with a general description of what can be achieved with the program and suggests its fields of uses. It has a full and clear description of what memory size is required and a step-by-step description of how to connect the equipment and enter the program. The instructions are so explicit that someone who had never used any part of the machine before should be able to get the program up and running.

The instructions which detail the running of the program are equally clear. Examples are given of each feature of the program and full colour pictures of the display are given for each step.

There is also a bibliography of publications dealing with statistics and the use of graphs. But not all the publications are likely to be freely available in the UK, especially as some of the publications date from 1950s.

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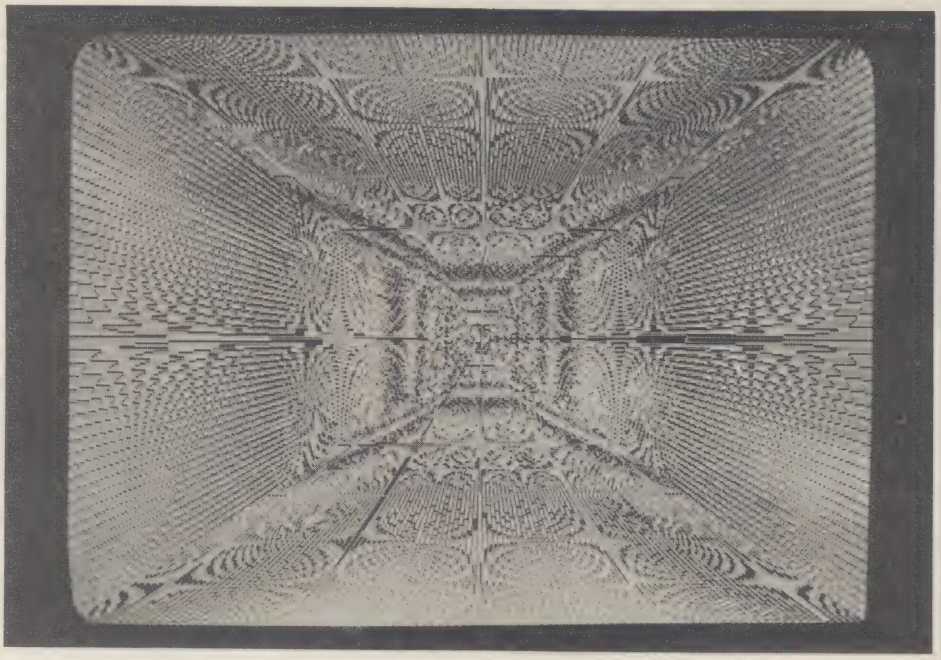
Television is one of the most exciting application areas of computer graphics. Now there's an add-on being used in TV which is within many micro users' price bracket. Pluto is a graphics board used by Diverse Productions to produce colour graphics for a Channel 4 current affairs programme. One of the people working on the project, Richard Monkhouse, a computer consultant and video artist, looks at the product.



At last a full resolution colour graphics generator board has arrived at a reasonable price. The Pluto graphics board is eight inches square and physically interfaces with the Nasbus, the standard interface for the Nascom micro. In fact, it can interface with virtually any micro if you design a simple bit of hardware.

Resolution is 640 horizontally by 288 vertically with three bits (eight colours) a pixel. The board contains enough memory for more than two screenfuls at this resolution, and so one screen may be drawn into while the other is being displayed, giving instant clear screen updates.

To view the picture a special RGB monitor is needed, rather than plugging the output into a TV, because of the special output signals from the board. The advantage of this is crisp, clear quality and resolution.

RGB monitors are much cheaper now than a couple of years ago, retailing at about £500. And I am told monitor prices are soon to take another price tumble.

The unit contains a 8088 processor, and so offers a much wider range of drawing commands than systems with dedicated controllers. With older micros this would have meant a slow speed for such useful commands as POLYGON-FILL, but the Pluto I saw, claiming a drawing rate greater than 100,000 pixels a second, filled a complex shape, about one half of the screen in size, in a second or two.

As well as plugging directly into a Nasbus, and with an interface adapter into the Sirius micro, I/O Research, the manufacturer of Pluto, plans an interface for the IBM personal computer. For those who like things simple, a boxed version with power supply and Sirius interface is available.

A great advantage of this board is the expansion options. The palette board extends the system with five extra memory planes and a table of colours, which gives the user 256 simultaneous colours from a possible 16 million. A piggy back plug-in extra increases the drawing rate to two million pixels a second, while a video frame grabber board allows real images to be manipulated. The two pages of graphics may be traded for doubled vertical resolution with an interlace option available as a £50 plug-in/IC exchange.

A Pluto board with an interlace options costs £450, plus VAT. But delivery may be a problem. I have been waiting seven weeks for mine.

BBC MICRO SOFTWARE

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This highly colourful arcade game has been acclaimed by all those who have reviewed it – see Beebug User Group magazine "...the game is really fun and very, very addictive.

FRUITY-TOOTY NEW **Model A or B** **£7.80** + VAT

This tape contains two fruit machine programs one each for the A and B models. Both make full use of the excellent colour graphics and sound effects and, like the modern electronic fruit machines, both feature nudges, gamble options, holds, etc.

CHESS NEW **Model B** **£10.00** + VAT

The best chess game available for the BBC Micro. The program has been developed over the last couple of years and this is the latest version for the BBC machine. It incorporates a host of facilities including an enormous range of skill levels – you can alter such parameters as the number of moves that the program looks ahead, the speed, and sub-levels, etc. The computer can act as umpire for two players. It can even play against itself. It is possible to change levels, even sides, when in the middle of a game and to set up 'problem' games and get the computer to solve them. Finally at the end of the game it is possible to see a replay move by move. This may be stopped at any move and normal play resumed from that point on.

This program uses high resolution colour graphics to display the board and its pieces. An excellent introduction for beginners though it still gives the experienced player a real challenge.

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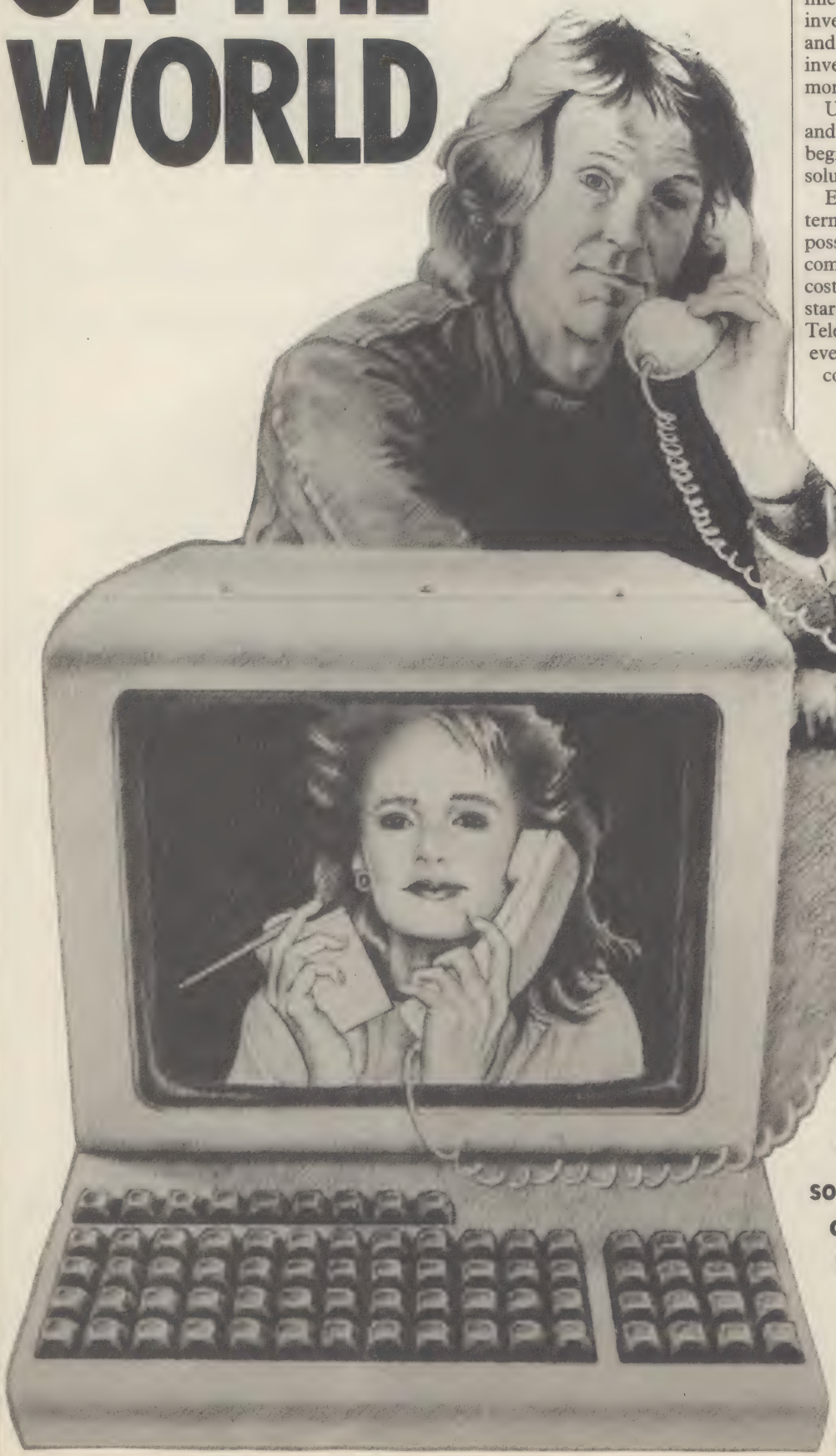

One of the biggest problems facing the microcomputer owner is what to do with the machine once he has got it.

It can revolutionise business, it can bring accounts up-to-date in moments, correct spelling errors, and remind the owner of his dental appointments. It can play chess as well as he can, and perhaps even synthesise a symphony.

But after a couple of weeks, the average user is going to start wondering what else the micro is good for, especially if he has just invested £2,000 or so in a business machine, and has come to realise that his £2,000 investment stands idle for 20 hours a day or more.

US users have faced that same problem, and come up with a solution which is just beginning to filter across the Atlantic. That solution is communications.

Everyone with a microcomputer, or even a terminal to a remote computer, already possesses most of the equipment needed to communicate with other computers. The cost of the remaining equipment has now started to drop with the abolition of British Telecom's communications monopoly, and even the hobbyist can now give it serious consideration.

'You can do the whole thing for £250 to £300 all-in,' claims computer enthusiast Leon Heller. 'All you need is either a terminal with the standard RS232 interface or a computer with the software to make it emulate a terminal, and a modem. You do not even need an all-bells-and-whistles modem – a simple acoustic coupler will do the job.'

Only recently have the prices of modems and acoustic couplers – both devices which attach a computer to a telephone line to communicate with a remote machine – fallen within the bounds of reason in this country. That single factor will revolutionise the microcomputer market in the UK, micro manufacturers predict, just as it has in the US.

Micro users on the other side of the Atlantic have taken to computer communications in a big way, and one of the reasons is that there are literally

'Bulletin boards are somewhat similar to amateur radio or citizen's band at the moment. They have started out as a bit of a gimmick, but I think they are capable of going a great deal further'

hundreds of hobbyist and commercial networks. Of those probably the largest, and certainly the best-known, is The Source.

'Everyone has an image of the massive computer in the sky, overflowing with data on everything under the sun. It will be a number of years before that image becomes a reality, but The Source is probably the closest thing to it,' claims The Source.

It is owned by Readers Digest and runs on a fleet of mainframes at a US-based bureau. It has set out to collect information on virtually everything, accessible to anyone with a microcomputer and a modem.

'The Source was set up with the concept that there is a massive amount of useful information sitting out there on computers, and all that it needs is someone to link it all together and make it available at an affordable cost.

'We have the entire United Press news database,' it says. 'Investment support devices, a whole mass of analytical data, business research, consumer services, home repair advice, health care information, and a shopping system with 30,000 brand name items at up to 40% discount prices.'

The Source does not only have static information which the user can access but not change, teletext style, but also incorporates an electronic bulletin board system, through which users can communicate and set up special-interest databases.

'The POST bulletin board system has about 80 different categories in it, one for just about every interest you can think of,' The Source says. 'Users can put up messages for each other, and scan across all the 80 boards by key words to track down messages for them personally or of particular interest to them. We also encourage the formation of new networks, and we provide support for the development of new specialist databases.'

So far the system, which started nearly three years ago, has notched up 18,000 subscribers, each paying a $100 subscription fee plus usage charges of $18 an hour at peak times, or about $4 an hour between midnight and 7 am, Virginia time. Two thousand new users join every month.

The cut-price night-time rates make The Source a better proposition for the British computer owner than it might at first appear, since they concide with peak business hours, UK time. That advantage helps to offset the daunting cost of the telephone call.

Indeed, The Source claims over 1,000 overseas users – 'At least a couple in virtually every country,' it says. But the company has no plans to set up on this side of the Atlantic, so would-be British subscribers must choose between expensive telephone call charges, or an expensive subscription fee to join British Telecom's packet switching service to cut the cost of the long-distance calls.

Furthermore, not all the company's overseas users are entirely satisfied with what they get for their money. UK hobbyists Leon Jay and Victor Saleh, both keen network users and former Source subscribers, complain that the system is too expensive and too unwieldy. 'It is very, very slow indeed,' grumbles Saleh. 'You have to plough through so many questions to get to the information you want, that it is a real waste of expensive connect time.' And journalist Guy Kewney also finds fault with the system's response time – frequently several seconds, he says.

Of its many services, The Source has found the bulletin boards the most popular to date, followed by the news service, then by the investment service. Games trail well behind, surprisingly. 'Everyone uses it in a different way,' says The Source man. 'You have to invest a certain amount of brain power to sort out how to make the best use of it to suit your own needs.'

Apart from this commercially-biased network, and the similar, but less ambitious Micronet, there are many other specialised on-line information services.

US networkers can also take advantage of several hundred bulletin board systems for hobbyists, run by hobbyists free. And that movement, at least, has found its way into the UK as well.

Victor Saleh is a Wembley watchmaker and jeweller. During the day, Saleh uses a Tandy TRS-80 to run his business and keep track of orders and accounts in the normal way. But several nights a week, between 7 and 10 pm, the Tandy microcomputer takes on a new identity as one of a handful of Forum-80 bulletin board systems open to micro users across the UK.

'Everyone has an image of the massive computer in the sky, overflowing with data on everything under the sun ... The Source is probably the closest thing to it'

'In the US, it costs $100 in membership fees to join The Source, and a whole lot more actually to use it,' Saleh says. 'But here in the UK, we do it for free.'

The Wembley bulletin board offers a stock of 30 to 40 programs available for anyone who wishes to download onto their own computer, completely free – apart, of course, from the cost of the telephone call. In addition, hobbyists are free to leave or pick up messages from fellow-enthusiasts through the bulletin board.

'Bulletin boards are somewhat similar to amateur radio or citizens' band at the moment. They have started out as a bit of a gimmick, but I think they are capable of going a great deal further,' predicts Saleh.

Since starting up last year, Saleh has found that about 20 hobbyists regularly use his system, which is set to take calls automatically several nights a week. Others call him from time to time, then vanish.

In a bad week, Saleh finds that the bulletin board may be used only three or four times. Other weeks, 20 or more calls come in. And of the 40 or so programs available to be copied, Saleh calculates that about 150 copies have been made since late last year.

The numbers are not impressive yet, but Saleh reckons he has quite a wide cross-section of the population among his users. 'Computer amateurs come from all walks of life,' he says. 'I'm a jeweller, and other users are doctors, solicitors, mechanics, salesmen, engineers, and, of course, quite a number of schoolkids taking computer studies courses.'

At the moment, Saleh's software library is aimed at the hobbyist. Most of his 40 programs are games, with a few simple database and accountancy programs thrown in for good measure. Some have been uploaded onto the library by users of the network. 'Some of the members will have to add new software to the system if we are going to keep the wheel turning,' he says.

Despite the bias towards hobbyists and the newcomer to computing, Saleh has no objection to seeing his system used for business purposes. 'I am interested in keeping the whole thing as amateur as possible,' he says. 'But if people want to use it for their businesses, good for them. They have to pay the phone bills, while it costs me almost nothing to run the system.'

As far as Saleh is concerned, the main attraction in running his own private network is the opportunity for making contacts and swapping ideas.

'A whole lot of very highly qualified programmers use Forum-80, and most of them are quite keen to help youngsters and newcomers to the game. If someone runs into trouble with a program they are working on, and leaves a cry for help on the bulletin board, the chances are good that they will get a reply to the problem from someone surprisingly fast,' he promises.

Saleh believes that the main problem facing the bulletin board amateurs is that almost nobody has heard of the movement. It is still too new to the UK, and to date only half a dozen boards are operating – two or three in London, a couple in Milton Keynes, one in Liverpool, and one in Hull. None operates round the clock as yet, although the Amateur Computer Club has plans to set up a full-time system.

For the newcomer to networking, it comes as a pleasant surprise to discover there is no complicated procedure involved in logging on and using a bulletin board system. 'The procedure is really quite trivial,' says Leon Heller, who co-runs the Milton Keynes Forum-80 system. 'You dial up the bulletin board system number, and the system answers the phone automatically. Then you simply place the telephone handset in your acoustic coupler, hit the enter button, and a welcome message comes up on your screen.'

A menu now appears, and the user simply selects from a number of options. He can enter or retrieve messages, and if a message is waiting for him, a flashing note on the screen will alert him to the fact – as long as the message sender has spelt his name correctly. Other options are the software upload or download facilities. The Forum-80 software prompts the user through the system, step by step, and there are help facilities available if he gets into difficulties.

'You don't actually need to know anything about computers to use Forum-80,' says Frederick Brown, a Hull microcomputer dealer and the founding father of the UK Forum-80 movement. His was the first non-American hobbyist bulletin board system. Brown caught the networking bug on a holiday in the US, and brought back a copy of the Forum-80 software as a souvenir.

Brown admits he has an ulterior motive for setting up his own electronic mail system. As a micro dealer, it is an ideal medium for

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Last issue we showed an example of 'short-listing' of employees for a prospective job. Here is an example of a garage stock file and two reports it might generate.
The record may look like this
1- record number (23)
2- part number (fiat grill 109)
3- location (bin 44)
4- cost price (29.00)
5- selling price (38.00)
6- minimum stock (5)
7- maximum stock (12)
8- current stock (3)
9- manufacturer (Fiat motor company)
10- on order (qty) (<9>)

One report might be: select??
all records where the current stock is lower than the minimum stock
When found, subtract current form maximum, and produce a printed list of the manufacturers name; part number; and re-order quantity
Update the record in field 10 with the quantity ordered.

Another report might be: select??
all records in the file; calculate the values of current stock multiplied by cost price for each record. Add the values together for every record at location London or Glasgow or Leeds and print a list of all such records showing stock values 'individual' and for the specific locations

(next issue's example sale ledger)

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selling to fellow enthusiasts. He has a shopping list for micro products and services on his system alongside the software library, which he believes to be the first computer shopping venture in this country.

Brown is a firm believer in the commercial possibilities of micro networking, and has developed his own business-oriented version of the software, which he hopes to sell to both amateurs and business users.

'Bulletin board systems such as mine are absolutely snowballing among businesses in the US,' says Brown. 'I see more of a future for local networks of this kind among business users than I do for an expensive national database like Prestel, where you pay for information by the page.'

Brown cites a Nashville bank which has set up a bulletin board system which its customers can use to instruct the bank to debit or credit their accounts, or pay bills.

One Washington printer has a system onto which people can simply load work which needs printing, whence it is fed directly into a typesetting machine. There are companies whose sales representatives go out on the road with portable terminals, and regularly dial up the company bulletin board to place orders or check prices.

The possibilities are almost limitless, particularly in the area of specialist systems, Brown believes. 'If every doctor had a terminal, they could ring through to a bulletin board database for information on available drugs, which could be loaded onto the system by the various drug companies as a way of getting free or cheap product advertising,' he says.

'You could set up a bulletin board system with one megabyte of storage for about £2,000. If 20 farmers clubbed together to do that, it would cost them £100 each, plus another £500 or so apiece if they don't already have their own computers,' Brown points out.

'And just about all the local papers in the US have a board for the general public to leave stories and letters, with perhaps some local information available too.'

The claims made for private in board to place orders or check prices.

The possibilities are almost limitless, particularly in the area of specialist systems, Brown believes. 'If every doctor had a terminal, they could ring through to a bulletin board database f sale at about £200, as a cheap modem for communicating with a bulletin system, and not just Prestel.

At present, the problem with that bright idea is that the modem needed for use with Forum-80 and the one needed for use with Prestel are not the same. They operate at different speeds, and are completely incompatible.

However, the new Gateway facility within Prestel, which allows a Prestel user to communicate with another computer, to access a private information service for example, may solve the problem. Networks with incompatible hardware may be able to communicate with each other through the Prestel Gateway.

Prestel itself does have a limited electronic mail facility, with pre-formatted messages available for users to send, bearing such sentiments as 'Happy birthday', or 'Drop dead'. It also boasts a software library, known as 'Aladdin's Cave'. However, on cost grounds local micro networks look likely to be a better buy.

For those users who are not satisfied with the choice between the costly Prestel service, the as-yet very basic and hobby-oriented bulletin board systems, and the trans-Atlantic phone calls needed to log on to The Source, a fourth option is coming to the UK.

Both Commodore and Apple users will soon be able to subscribe to a network set up specifically for their machines. Both networks are due to be launched this year, and both are likely to expand shortly after their launch to accommodate users of other makes of micro.

The Commodore scheme, Petnet, is aimed chiefly at the education and software development markets. Nick Green, Commodore's special projects manager, says Petnet services are likely to encompass information about Commodore equipment, an information service for users in education, software for sale, and free educational software.

'We see Petnet's main role in the education field, as a means for teachers to exchange and distribute software without cost,' says Green. 'We don't intend to be a high-cost service.'

The Apple-based project is more ambitious in its scope. It is being put together by the National Computer Centre, the Enterprise Systems Group, and AP Systems, and in effect it is a British version of The Source.

'We took The Source as the basic idea, but we are putting in various ideas of our own on top of that,' says Peter Rhodes-Dimmer, chief executive of Enterprise, on whose computer bureau the service will run.

The project revolves around the NCC, which has designed a low-cost communications card including a Prestel-compatible modem, to slot into the back of an Apple II micro. That should sell for about £200, Rhodes-Dimmer predicts.

The plan to offer electronic mail, tutorial and financing systems, home information, and a whole range of both hobbyist and business applications, according to Rhodes-Dimmer. And it should not be long before it opens its doors wider to admit users of other computers, and other modems.

'We want to have a range of three or four different types of interface available to cover everyone's requirements by the end of this year,' he promises. 'If we were to make this kind of thing available on something like the Sinclair micro, that would really widen our scope.'

With a Source-style home services network system on offer in the UK at last, the incentive to invest in a modem will be far greater than it has been up to now. That in turn should send prices dropping dramatically, especially if all the hundreds of thousands of users of the low-cost Sinclair micro also begin to jump onto the bandwagon.

It should not be more than two or three years before that hypothetical new computer owner, far from wondering what on earth to do with his micro, will be at a loss to imagine what he ever did without it.

By Shirley Fawcett, staff writer on *Computing*.

✻ Forum-80's HQ at Hull is on (0482) 859169. Forum-80 Milton Keynes is on (0908) 566660 and Forum-80 London is on (01) 747 3191.
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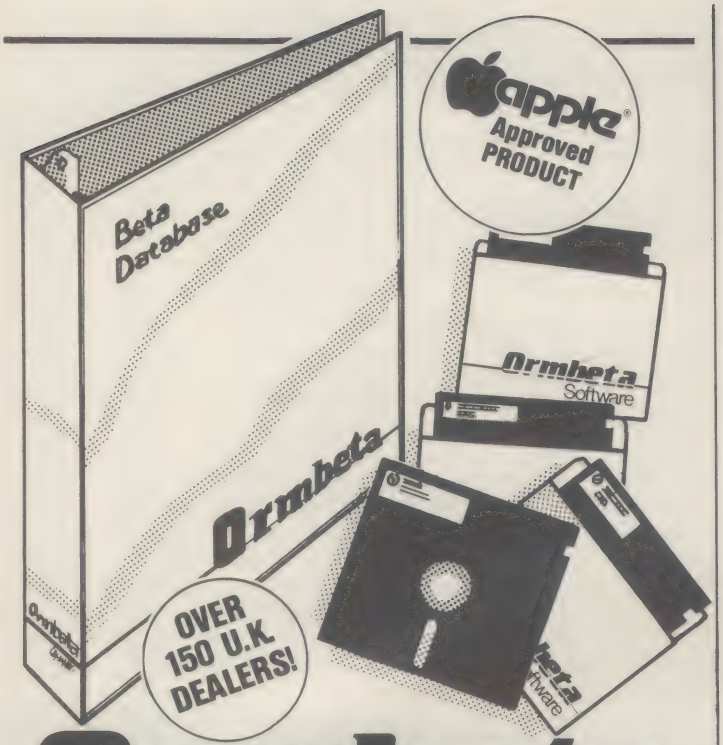

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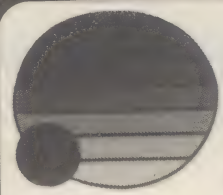

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DATABASE

Database management systems are all things to all men. The problem with assessing the performance of a particular system is that every application will differ in some way from every other.

A database management system is a program you need when you wish to keep a list of names and addresses, or stock items, and need to select parts of the information using certain given parameters.

If you are an insurance broker, for example, you might need to know quickly how many policies are held by women under 30 driving cars over 10 years old.

Under a manual system this would be an awful lot of trouble. An effective computerised system should give you the information in seconds.

But database management is surrounded by controversy. Many critics imply that micros are too small and too slow to be effective. Database management is one of the oldest computer applications and grew up on the giant mainframe computers used by large companies and corporations throughout the world.

That database management on a micro is limited is undoubtedly true, if only because of the inevitably limited storage capacity of a smaller machine.

But with powerful hard disks being used more often as part of microcomputer systems, the database management system is likely to become a much more familiar application.

Some software companies are, in fact, recognising the limitations of their systems and selling them under a different or modified title – such as data management or information retrieval. Other systems retain the database management tag, but their capabilities and indeed their prices vary radically.

The choice for most users, however experienced, is becoming bewildering. To reach a proper decision they are going to have to look very carefully at a number of systems before signing on the dotted line. And it is all too easy to underestimate the size of the system needed to do an adequate job. Too many users have happily bought a database system to use with floppy disks and discovered that they simply do not have enough storage space and then had to fork out another few thousand for the latest hard disk technology.

One company which is careful to call its system a data management system is Microtrend, whose Trendisc program is one of the more established in the micro field. It's been around for 18 months and European sales have topped 2,000. English, French, German and Dutch versions are available.

I have used a database system on a mini and would like to get one for my micro. Are micros too small for database management? If I do buy a system will I need to fork out on extra memory and disks as well?

David Hebditch of Microtrend

In a way, Microtrend has sacrificed some functions to make the package accessible to the naive end-user. 'Trendisc 1 is designed with the emphasis on user-friendliness,' says David Hebditch of Microtrend. 'It is ideal for record keeping in small companies.'

Trendisc 1's functions are typical of many micro systems with one or two refinements distinguishing it from the rest. It enables you to describe the record format you require and store up to 50 items in a record. It has a 'browsing' facility and allows you to access a file with very tenuous information.

If, for example, you were looking for a Mr Tom Smith of Coronation Street, Bolton-on-Sea, but you could remember only the 'on-Sea' part of the entry, the system should be able to sort through the records intelligently and come up with the one you want.

'In fact, the system has 90% of the functions of a full database management system,' explains Hebditch, 'but it is done in a simple way. This is the challenge for us as software writers.'

Trendisc also links to a word processing system, enabling the user to do things like printing out address labels at will.

The price of Microtrend's system provides a good guide as to what you can get for your money. Trendisc 1 is only £150, while the word processing package is £350.

But while he is justifiably proud of his system, Hebditch has few illusions about the limitations of database management packages in general – including his own. 'The access time is very slow. This is something which applies to all database systems.'

Hebditch is not convinced that the new generation of 16-bit microcomputers is going to make all that much difference. 'Even using a mini-Winchester the access time is slow,' he says,

However, Hebditch is certain of one thing, that the system will have been used for an enormous variety of applications. 'One of our problems is that we have no idea what it has been used for,' he says.

A system which has proved quite popular on CP/M machines is produced by a company called Grade One. Called, Rescue, it costs £450, and as Grade One's David Reeve explains, it bears out Hebditch's notion that such a system is likely to be used by a wide variety of people.

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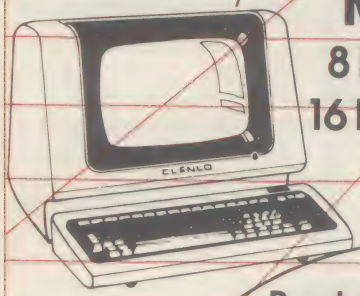

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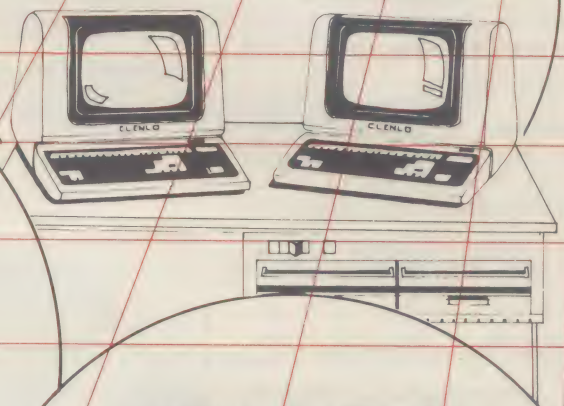

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own internal requirements,' recalls Reeve. 'But we have since sold systems to insurance companies and brokers, to fund-raising consultants and to other institutions.'

However, Reeve explains that he doesn't place quite the same emphasis on simplicity as Hebditch.

'We use this package as a starting point,' says Reeve. 'The raw end-user might find it difficult to get the best out of all its facilities.'

As a result, Grade One tends to spend quite a bit of time with the user after a sale. Reeve claims they will spend as much time as necessary with the user to make sure they are getting the best out of the system. 'You need specialist knowledge to use it to the fullest extent,' he says.

One man who has had the benefit of Reeve's advice and support is Bryce Walker who runs a specialist insurance office. His company already uses a larger minicomputer, but decided a micro might be a good idea for data capture. So he bought a North Star Horizon, a Corvus hard disk drive, and Reeve's Rescue system. Proposals go onto the micro and are only transferred to the mini when they become firm policies.

'We handle between 150 and 200 proposals a week and there is absolutely no way we could do all that manually,' says Walker.

It is interesting that Walker has gone for a database-style system rather than choosing one of the many packages which claim to be specifically designed for insurance companies. 'We are an equity-linked life office,' explains Walker. 'Our requirements for records are limited and specialised.'

Using a database system like Rescue, Walker can draw up his own requirements for the system and not be tied down to the parameters developed for some other insurance company with different needs. As businessmen become more acquainted with the potential of microcomputers, this could become a familiar trend.

Although an insurance broker's package may suit one broker, another might find it restricting and unhelpful. Using a database system, he may have to work harder in the first place, but may eventually end up with a far more satisfactory system.

A more expensive system, but one making even greater claims than Grade One, comes from G W Computers in London. This is the DBMS2 which alone costs over £500, but comes virtually free if bought with the Superbrain systems which GW supplies.

GW's own description of DBMS2 carries some nice examples of the kind of thing you ought to be able to get a database system to do. If you run a medical practice for example, you may wish to know something like this: 'Find all patients who suffered from colds, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than three; do not smoke; have more than three children, are currently at work and where treatment failed to effect a cure in under six days. When you find such persons then print a list showing their age, marital status, income, and frequency of illness in the past two years.'

It is doubtful that you would ever need anything so detailed, but it would be interesting to know just how complete a list such a command would supply. Tony Cooper, who runs Shadow Electronics, a company designing equipment for large organisations such as Shell and Pye, is one of the most established of DBMS's users.

Cooper is now very happy with the system, which he is using on a Superbrain computer. 'I am able to do reports and accounts very much quicker than I used to,' says Cooper.

But it has not always been easy. Cooper had a lot of mishaps since he first thought about computerisation a couple of years ago, and it is only through his own perseverance that he has succeeded.

'I got ripped off all over the place,' says Cooper. 'Originally I bought an 8K Pet, but it took ages to load. We got a twin floppy disk drive, but the left one never worked.'

After various attempts to get it fixed, one company said it would have to take in the whole system. It did so, but Cooper was not happy when it was returned to him. 'It was full of mouse droppings,' he recalls.

One database user advises planning ahead, and thinking out clearly what you want, especially whether you will need a single user system, or one which can be expanded to cope with a number of users

At this stage, Cooper decided to buy something else. He went for an upgraded Pet and was sold DBMS to go with it. But again he had problems and kept losing data.

'Eventually I caught up with Tony Winter, the author of the program, and between us we got the system working. At that time, I noticed he was using a Superbrain which seemed a lot faster and better.'

For Cooper, that was the start of what he describes as 'intelligent programming'.

Since then he has received constant support from Winter – whether other users would get the same treatment is debatable – and feels that Shadow has benefitted immeasurably from the system.

But Cooper has learned a few lessons along the way. 'I would advise anyone to plan ahead and think out clearly exactly what he wants,' he says. 'You must decide whether you want a single user system or whether the business is going to grow so that more people will want to use the computer.'

Most important of all, it is crucial to evaluate the solution before making any move at all. Cooper realises now that if he had known more when he started, he may not have had a computer full of mouse droppings.

While people like Cooper have chosen to start at the bottom end of the market and leave themselves room for expansion, others have felt confident enough to start with much more powerful machines.

DMS, a system produced by Compsoft, was, in fact, originally designed for the Commodore Pet, the machine Cooper started with. Now it is available for CP/M machines and is being used on some very expensive equipment. More than 3,000 copies of the system have been sold of which between 500 and 600 are for machines using the CPM operating system. The system retails at £400 from Compsoft and local dealers, and is going to be available for both the IBM Personal Computer and the ACT Sirius.

Ron Stevenson of Typographical is using the system for commercial mailing lists on an SD 700 computer from Circle in Surrey. Altogether he has spent about £17,000 on his system.

Stevenson went for the package rather than a standard mailing list program because of the degree of flexibility it allowed him. 'DMS allows me to evaluate the marketing side of the business, and unlike a standard package it is not limited in the amount of information I can get from it.

'With this system I can simply provide a better service.'

Stevenson may be typical of the new business executive who sees the computer as more central to business. While many small packages claim to be 'specialised', many people may realise that an easy-to-use, well designed database system might be better.

They can take a system, and if it is sufficiently 'user-friendly' and they are sufficiently patient, develop it to suit their needs. But it is crucial they have a clear idea of the solution they are looking for, and reliable back-up from their supplier.

By Peter Wild, senior staff writer for *Micro Decision*

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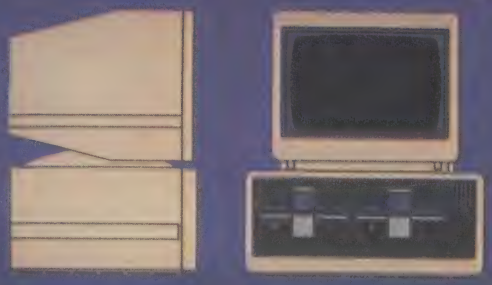

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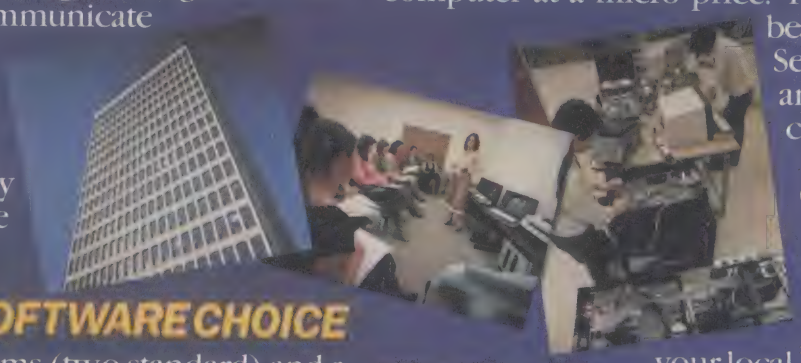

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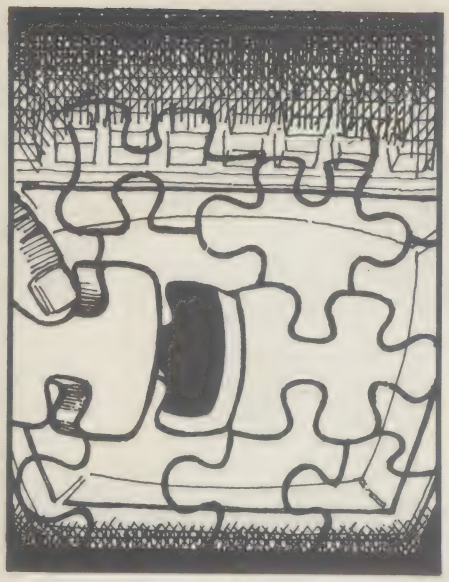


The character of a micro, especially one that use floppy diskettes, is largely determined by the operating system it uses. This important piece of software also dictates which software you can run. In this section we open up the operating system, to find out what's inside for the user.

P-SYSTEM: AN ALTERNATIVE TO CP/M?

My disk-based machine has the CP/M operating system, but I want an alternative which will make the job of programming easier. Is there one available? If so, what are its advantages?

Which would a motor mechanic prefer: mending the car by the roadside, and having to use tools scattered around the road, or mending the car in a fully-equipped garage?

An easy question to answer, if you ignore the cost of using a fully equipped garage. So micro users, especially those who want to get some grease under their fingernails, will be pleased to learn that they seem to be faced with a similarly easy choice: it is between CP/M and the usually more expensive UCSD p-system.

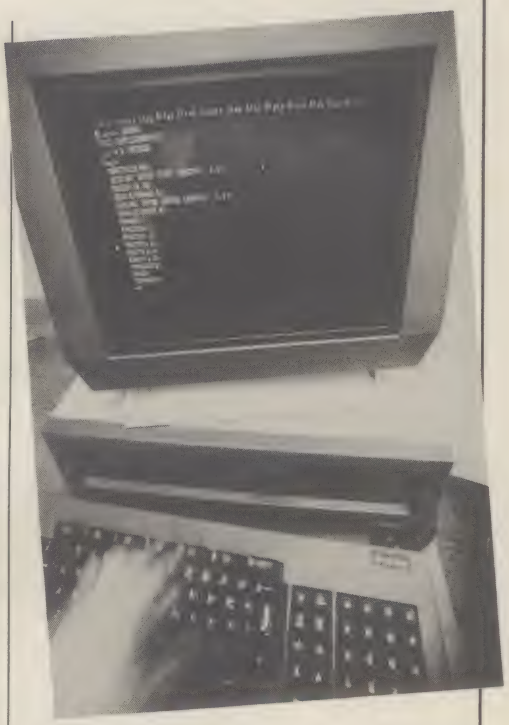
CP/M is one of the most widely-used operating systems for floppy disk-based machines. A micro that runs CP/M is usually able to run a huge variety of programming languages and applications programs. But by no stretch of the imagination is it the fully-equipped garage of the operating system world. It doesn't supply a suitable 'environment' for programming.

The tools needed to make a program are themselves programs, as CP/M makes obvious. They include editors, compilers, interpreters and a set of filing utilities. With CP/M they are scattered around the place, and have to be regularly fetched and carried.

The approach adopted by the UCSD p-system is different. UCSD stands for University of California, San Diego, the branch of that huge American academic institution that developed the system. It is, like CP/M, a piece of software.

Rather than have the programming programs scattered around, they are all, from the user's point of view, part of an 'environment'. Under most circumstances there is a menu of options across the top of the screen. These offer access to the various tools you may need to write or run a program.

To find out what sort of facilities the UCSD p-system offers, we borrowed a version of the system designed to run on the ACT Sirius, developed and supplied by a company called TDI. Bar the installation procedures,



UCSD running on a 16-bit Sirius micro.

the Sirius UCSD p-system should be virtually identical to any other, as all implementations use the same basic system, supplied by the American firm Softech.

When you start up UCSD, the first thing you see is the main command menu. This offers a number of options, including edit, run, file, compile, execute and assemble. You choose the option you want by pressing the appropriate letter to the keyboard, which is indicated by the way the options are displayed in the menu (for example, edit is displayed as Edit, so you press the 'E' key).

When you have selected a particular command, you then get another menu of options. So, if you want to edit something, you press 'E', and soon you are offered some of these facilities: A(djst, C(py, D(lete, F(ind, I(nsrt, J(mp, R(place, Q(uit, X(chng and a peculiar option called Z(ap.

Thus UCSD is said to provide an environment: at all times you are surrounded by the tools you will need, and selecting them entails nothing more than pressing a single key.

UCSD offers you more sophisticated tools than CP/M, at least when you're programming in a high level language like Pascal. This is especially so in two major areas of

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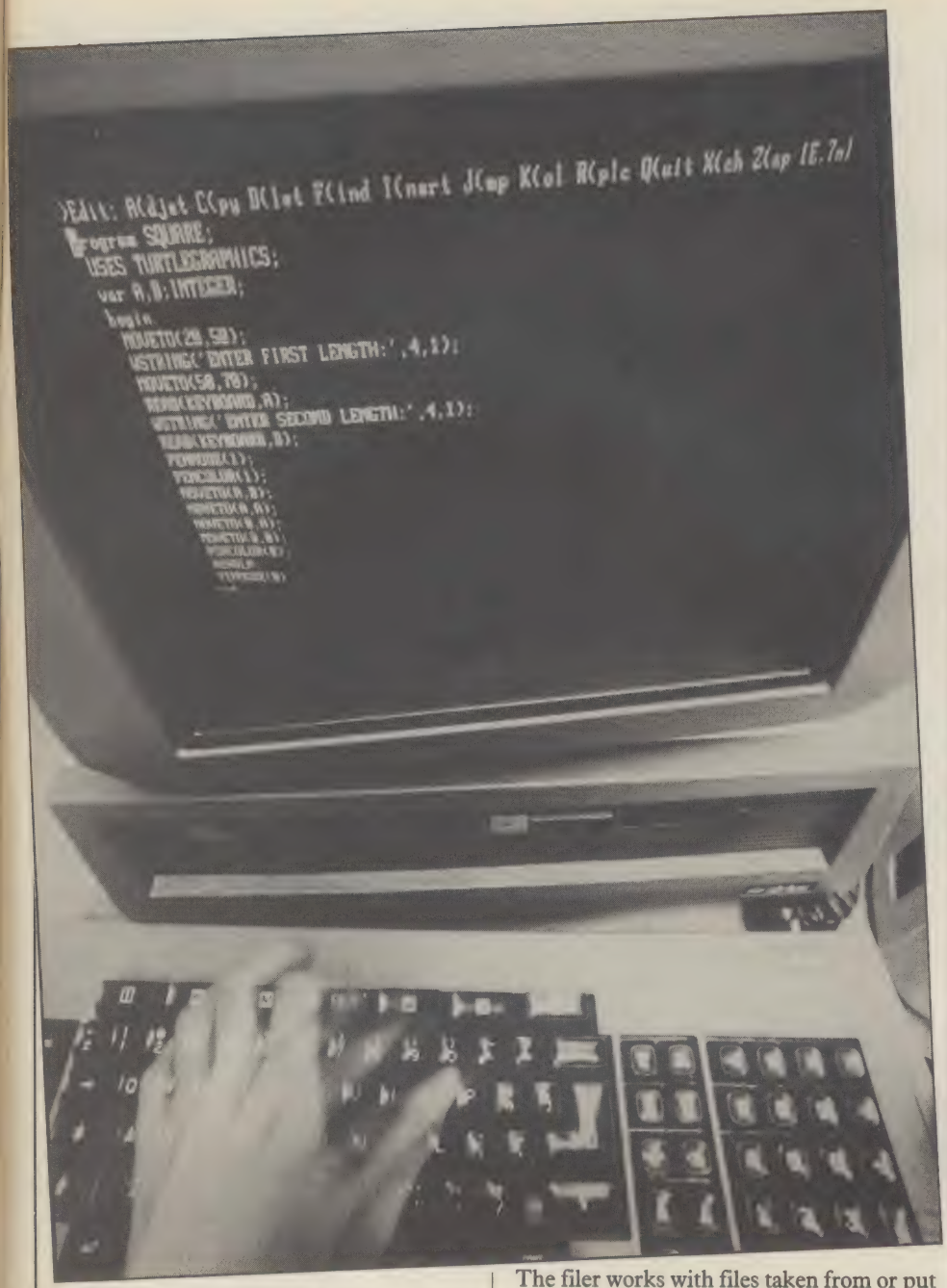

programming: editing and filing. UCSD usually comes with two editors: a screen editor and something called YALOE (standing for Yet Another Line Oriented Editor). In programming you need an editor to write and edit programs.

The standard UCSD editor is a screen editor, you can move the cursor to anywhere on the screen. YALOE, and the editor supplied with CP/M, are line editors, you can only edit one line at a fixed place on the screen. YALOE is supplied with UCSD for use on machines without the necessary built-in facilities for screen editing, and would rarely be needed with modern micros.

The UCSD screen editor is so powerful you could use it for word processing. You can find bits of text, replace them with something else, define blocks of text, set margins and create columns. Some of these things can be done using the CP/M editor, but not with the same ease.

The UCSD filing system, the filer, is bursting with facilities. You need a filer to administer the files that are held on disk. When you call up the filer you get these options: G(et, S(ave, W(hat, N(ew, L(dir, R(emove, C(hnge, T(ransfer, D(ate and Q(uit.

The filer works with files taken from or put into volumes. The disks are volumes (each having their own name), as are the output sockets (or 'ports') used to connect to peripherals. It can be used to list the files on the disks, to transfer files between volumes, to datestamp files, to get files from the disk, and to put them back. To do these things under CP/M, you have to call up the appropriate program. With UCSD, it is simply a case of pressing the right key and entering the appropriate parameters.

When you're working on a program, UCSD stores it as a 'workfile', so it is always to hand when you're editing or filing it. This facility builds up the environment that takes a lot of the pain out of administering the programming process,

Before those of you who are CP/Mers start thinking that you're on the wrong course, there are a few other things you should know about first. They relate to the UCSD p-system's combined vice and virtue: p-code.

The UCSD software creates what is sometimes known as a 'virtual machine' inside the real machine. The word virtual is used in computing to mean simulated. With a virtual machine, the software stimulates different kinds of hardware: it sets up a ghost in the machine. The ghost created by the UCSD system is one that uses its very own machine code, called p-code, which resembles and was derived from Pascal.

To a piece of UCSD software, all machines running the UCSD p-system look the same: they all run p-code. In fact, they don't. An interpreter is used to translate the p-code into the machine's native code. But the programs you write with UCSD are compiled down to p-code, and stored in that form. They should be portable down to p-code, and also stored in that form. They should be portable across the entire range of hardware that supports UCSD.

The only thing that would compromise the portability of a p-code is the problem of getting the program into another machine's memory. Users have found that a diskette from an Apple may be of the right dimensions to fit into an Osborne, but the Osborne will still refuse to read the contents of the Apple disk. Disks just will not work on different types of machines.

Softech plans to overcome this problem with a product called the Universal Medium, which will allow you to put a disk from a different machine into the UCSD system and read its contents. Once the Universal Medium becomes available next year, at a cost estimated to be about £150, the UCSD p-system will offer unrivalled portability.

The bad news about p-code is that it does impose restrictions on the system. Being Pascal-based, it is thought to be unsuitable for languages like Cobol. It would be complicated to compile Cobol statements into a set of Pascal-like p-code instructions. UCSD does offer Basic and Fortran compilers, but these are claimed by critics to be slower than compilers that don't have to cope with an intermediary like p-code.

Arguments about speed are as much a part of discussion about UCSD as any other software. The proof of the system will come when more applications programs are developed.

In this respect, CP/M reigns supreme. A huge quantity of applications software will run under it, far more than UCSD has.

As an environment for Pascal programs it can't really be faulted, especially when compared with CP/M as a Pascal environment. But the comparison is unfair, because UCSD was built for Pascal, and as not everyone would choose to use the language it does not share CP/M's virtue of being general purpose.

At least, not yet. The possibilities of p-code, or a derivative, have yet to be fully explored. The system is a newcomer to the commercial environment, and until now has enjoyed the altogether different challenges of the academic environment.

✻USUS(UK), the UCSD user group, contact Mark Woodman, Maths Faculty, Open University, Walton Hall, Milton Keynes, MK7 688, telephone: 0908-653148, or John Ash, Asolv Ltd, 12-14 Church Street, Basingstoke, telephone 0256-795746.

✻ Further reading: The UCSD Pascal Handbook by Clark and Koehler, Beginners Guide for the UCSD Pascal system by Kenneth Bowls.

By Benjamin Woolley, editor of *Computer Answers*.

Software Released

The Hardware Barrier

Whatever microcomputer you own or use its capability has been limited by the availability of software as this is generally designed to run on a specific type of machine. And all too often that important software package has been unavailable on your machine. This restriction has necessitated the benefits of hardware being traded off against software availability with consequent loss in efficiency. Now there's the Master System.

The Key to Freedom – The Master System

The Master System removes the language barrier imposed by a machine giving you total freedom of choice in both software and hardware. So that you can select the software best suited to your needs to run on the machine you prefer. It also means that you can write a program in your choice of languages, confident that it can run on **any** microcomputer upgraded to the Master System **without change or amendment.** As a result software can be made more versatile and with a far broader application.

The Master System – Powerful and Comprehensive

The Master System – the UCSD p-System (Version 4) software is the operating system of the future. It comprises a powerful suite of languages including Pascal, Basic, Modula 2 and Fortran and corresponding compilers. Cobol will be available shortly.

Choose your Language

Different computer languages offer different benefits to the user. Such is the Master System's versatility that even a program having modules written in different languages can be run and executed. This allows you to capitalise on the advantages of particular languages avoiding their weaknesses.

An Investment for the Future

With advances in microcomputer technology happening so fast, your major concern is whether your investment in today's technology will be protected in the future. The Master System is designed to give your needs that protection. Software and Hardware houses such as IBM, Apple and ACT Sirius 1 have already adopted the Master System and it is gaining rapid worldwide acceptance. More than 30,000 users have chosen it. Increasingly the Master System will enable you to take advantage of the latest software releases. As your computing needs grow you may outgrow the capacity of your microcomputer, the Master system ensures that your investment in software programs and important data is protected without restricting your future hardware options.

Complete Documentation

The Master System is currently available as a software package comprising a diskette and comprehensive documentation. The Master System is also being built to accommodate Winchester based systems.

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GO SLOW FOR MULTI-USERS

Is a multi-user system as good as it sounds, turning a personal computer into something that lots of people can use? What are the drawbacks? What are the advantages over networking?

Adapting a micro so more than one person can use it can be a false economy. It may save money initially, but could cost dearly in time.

Multi-user operation, an innovation borrowed from the mainframe computer, shows up the limitations of the micro. A microprocessor can accept only one instruction from one source at a time, so in a multi-user system it runs part of each person's work in turn.

This switching happens so quickly it creates the illusion that everyone is using the computer at the same time. But as the number of users increases, so programs take correspondingly longer to run.

And this delay can render many applications impractical. Word processing is an example of this, for the micro must run quickly to match even the average typist's speed. If too many people use the micro at one time, very soon they will have to wait for the computer to catch up.

Multi-user systems for micros were developed when central processing units were expensive and needed to be shared. But even 16-bit micros run out of power as new users join.

But there is an alternative—networking. This is a system where micros are linked, while sharing expensive resources such as printers and hard disks.

Adding users does not degrade a network. And if the expensive items, such as sophisticated printers, are shared, the idea is even more attactive.

For example, typists prepare text on their own micros without suffering delays in response time. When each letter is finished it is sent to shared hard disk, to be printed when the printer is ready. The typist is free to do the next letter immediately, because the queueing between the hard disk and printer is handled automatically by networking software.

CP/NET, produced by Digital Research as an extension to its CP/M operating system, is an example of this for it controls communications between various devices on the network.

Handling communications in this way is fine for an application such as word processing, where each person works independently, but some applications require a greater degree of coordination than networking can provide.

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Q&A

Stock control is one area in which a multi-user micro could compensate for its delay in response time by offering access to shared information.

Many companies receive telephone orders that depend on an item being in stock, and a multi-user micro can help maintain an up-to-date stock record. Two clerks can use their terminals to deduct items from a master stock file while the third adds to the list as goods arrive from the suppliers.

But before it is possible to have shared access to the same file, the multi-user operating system must protect against two users trying to change the same item at the same time.

This is achieved in two ways; by denying other users access to a file (file locking), or by stopping access to one part of the file (record locking).

Record locking is the best method as users are less likely to get in each other's way. But many multi-user operating systems do not have record locking and, where they do, it is usually an afterthought.

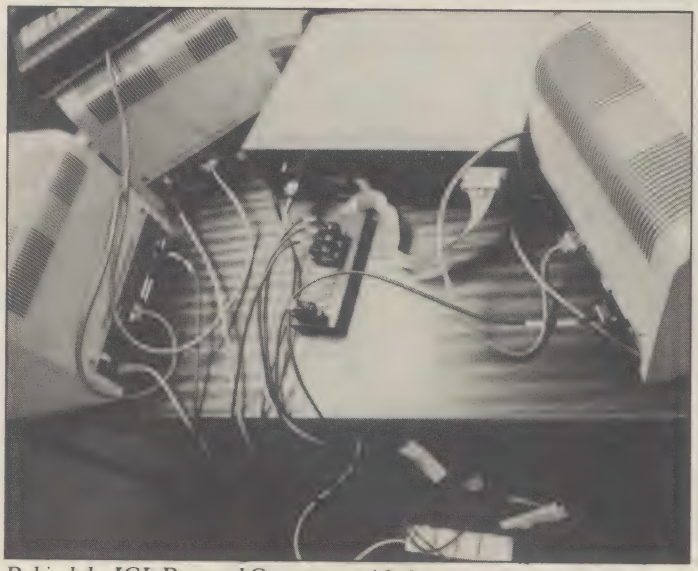
MP/M, the multi-user equivalent of the CP/M operating system, supports record locking, but the provision is not automatic and currently available software will not take advantage of it.

This problem will probably surface again when the new generation of 16-bit micros reach the market.

This new breed of 'supermicros' will offer the same performance as some of today's mini computers. Many will use the Unix operating system, which is already popular on larger computers.

The standard form of Unix does not have record locking, so its suitability for multi-user micros is questionable. It is being adopted for micros because it is written in a powerful, high-level language and so it is easier to tinker with than other operating systems which are written in machine code.

Already manufacturers have rewritten Unix to make it more 'user friendly', for example Microsoft with its version called Xenix, and Onyx with another version called IS1, developed by Interactive Systems Corp.



Behind the ICL Personal Computer, with three terminals attached

The danger with having several versions of Unix on the market is that they won't necessarily be compatible, which can lead to a shortage of suitable software.

There are advantages and disadvantages of multi-user micros and alternative networks. So why not combine them and have the best of both worlds.

There has been a lot of work on a networked version of Unix both in the US and in Britain, notably at Newcastle University, but cost is the main drawback to such a system.

Digital Research has also worked hard in this area, with a product called MP/NET. This will work with the MP/M system and will also link with CP/NET to work with the single user operating system, CP/M.

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GET MORE FROM CP/M

Can the CP/M utilities PIP and STAT only be used for copying diskettes and finding out their capacity, or do they have other uses?

PIP and STAT are the two most versatile utilities available on a CP/M compatible micro, but before we examine them it's worth looking at general features of the CP/M operating system.

The DIR command displays a directory of the disk contents. Programs are easily distinguished as their names nearly always end in COM. A word processing program might be called WORDPROC.COM.

You may decide that all your reports will have names like ANNUAL.REP, COST.REP and so on, and that all letters will end in .LET. Later, you could type DIR*.REP and only those items of text that ended in .REP would appear on the screen. DIR tells you what is on the disk, but how do you find out how much room your letters take up?

This is where STAT comes in. You will know if you have STAT on your disk by using the DIR command again. As STAT is a program, it will appear on the directory as STAT.COM. To run STAT simply type STAT, and a message like 'BYTES REMAINING 23k' will appear.

This means you have room to store roughly 23,000 more characters of information on your disk. If you type STAT*.*, you can see how big each item is. The asterisks after STAT stand for 'any name'. So you could refine your use of STAT to STAT*.REP to show you how big each report is.

STAT has another function. If you decide that your annual report should be for your eyes only, you can use STAT to stop it appearing on the directory when the DIR command is used. If your report is called ANNUAL.REP then type STAT ANNUAL.REP $SYS and nobody will know that it is present on the disk. To reverse the process, type STAT ANNUAL.REP $DIR and the report will appear again.

You can also use STAT to turn your report into a read only item. This means that nobody will be able to change its contents. To achieve this type STAT ANNUAL.REP $R/O, and to change it back to normal type STAT ANNUAL.REP $R/W.

PIP is used to transfer the contents of one disk to another, but most systems already have a disk COPY utility, so what can PIP do that COPY can't? PIP can transfer items selectively.

Let's suppose that your disk had been filling up with letters and reports until STAT told you there was no more room. Rather than start a new disk, it might make sense to transfer all your letters to a second disk, and reserve your original disk for reports. PIP will copy an item like ANNUAL.REP from a disk in the main drive A to the second drive B if you type PIP B:ANNUAL.REP=A:ANNUAL.REP.

Notice that the disk drive you are copying to comes first. Now type DIR B: and you will see that ANNUAL.REP has copied to the B drive, but it will still be present on the main drive. To remove it, type ERA ANNUAL.REP, but make sure it has copied properly first.

You could repeat this process until all the reports were on the second disk, but there is a much quicker way to do it. If you typed PIP B:=A:*.REP all items ending in .REP would be copied to the second disk, and you could remove them from the first disk with ERA*.REP. Erasing several items at once sounds dangerous.

Luckily, PIP has a verify function. It checks the data as it copies to make sure that it matches the original, and stops copying if there is any error. To invoke the verify option put 'V' in square brackets at the end of the PIP command, for example, PIP B:=A:*.REP[V]. If your keyboard does not have square brackets then Control – K will produce the opening square bracket, and shift – M will produce the closing bracket.

PIP can also copy itself, or any other CP/M utility program, so it is probably worth putting PIP and STAT on every disk.

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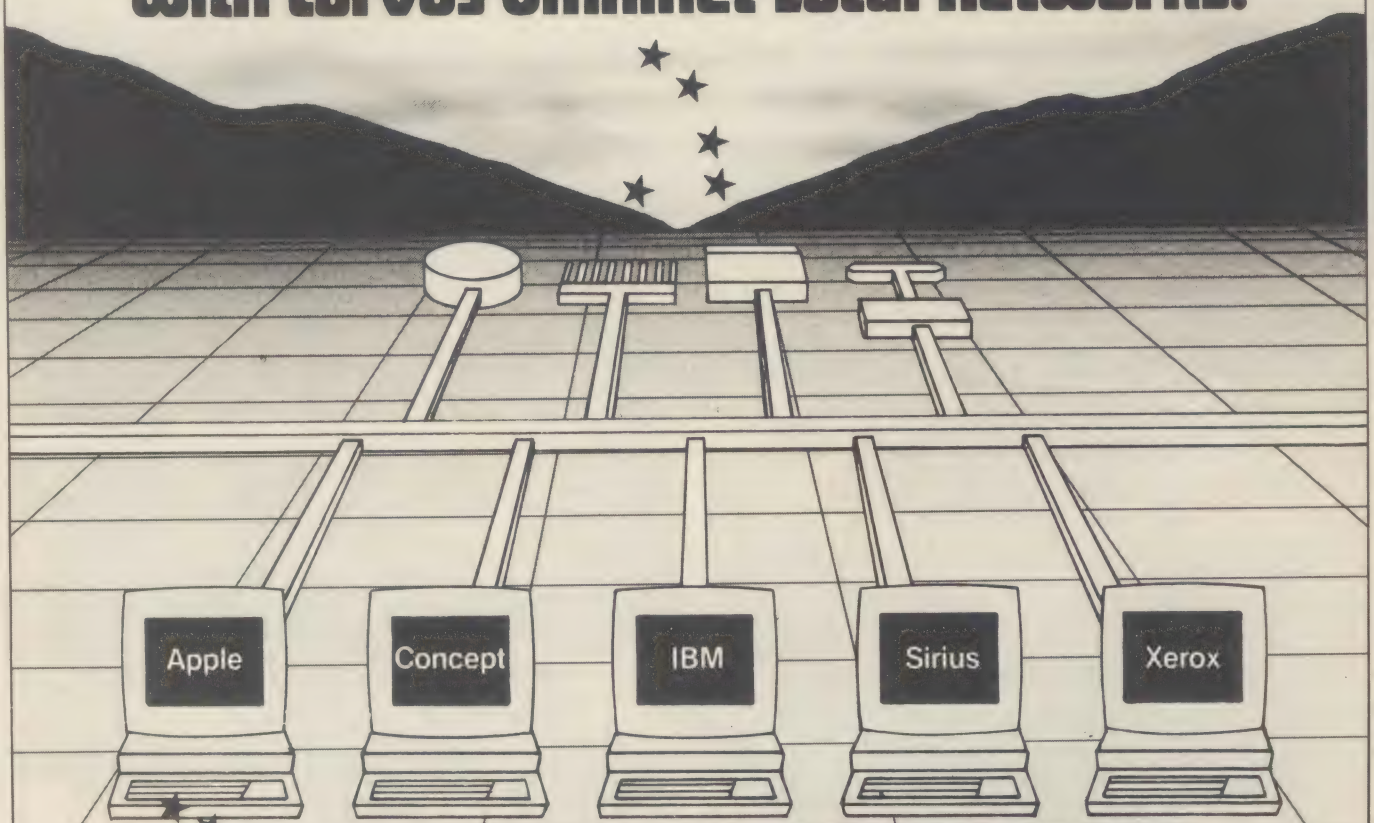

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CLEVER QUERIES

This section is designed to take some of the strain out of buying a microcomputer, by offering you advice on what to look for and how to avoid the legal hassles. In this issue we look at the legal implications involved when the software you buy is not up to scratch. We also give some ideas on how to test software on your own.

When buying hardware and software what are the right questions to ask the salesman? What pitfalls should I look out for?

Watch beginners learning how to play chess, or how to ride a bike, or translate an English phrase into a language that is totally unfamiliar.

The one thing they all have in common is the ability to ask intelligent questions about the game, or the language, but their questions aren't the right ones.

'Why can't Black have the first move for a change?' suggests the board strategist. And 'Teach me how to ride slowly first, so that I don't fall off, and I'll learn to ride fast later.'

Similarly, people persistently ask me questions like: 'What's the best machine for playing games and doing calculations?' or 'Can the IBM micro work out the square root of a minus number?' and 'If I want to write a program to control my central heating, should I buy a machine with disks?'

The first two questions everybody should ask before buying a piece of computing hardware are: 'Do I know enough to buy a computer?' and 'Are there any right answers when it comes to buying a computer?'

The answer to both questions is no. So, what sort of mistakes can the buyer make?

I could talk at length on this subject, without repeating anything, and quite possibly without touching on the mistake that the buyer is planning to make.

The worst mistake anybody can make is to remain ignorant.

The next mistake is to set about acquiring knowledge through reading about computers. Computers are like bicycles: you can learn only from the machines.

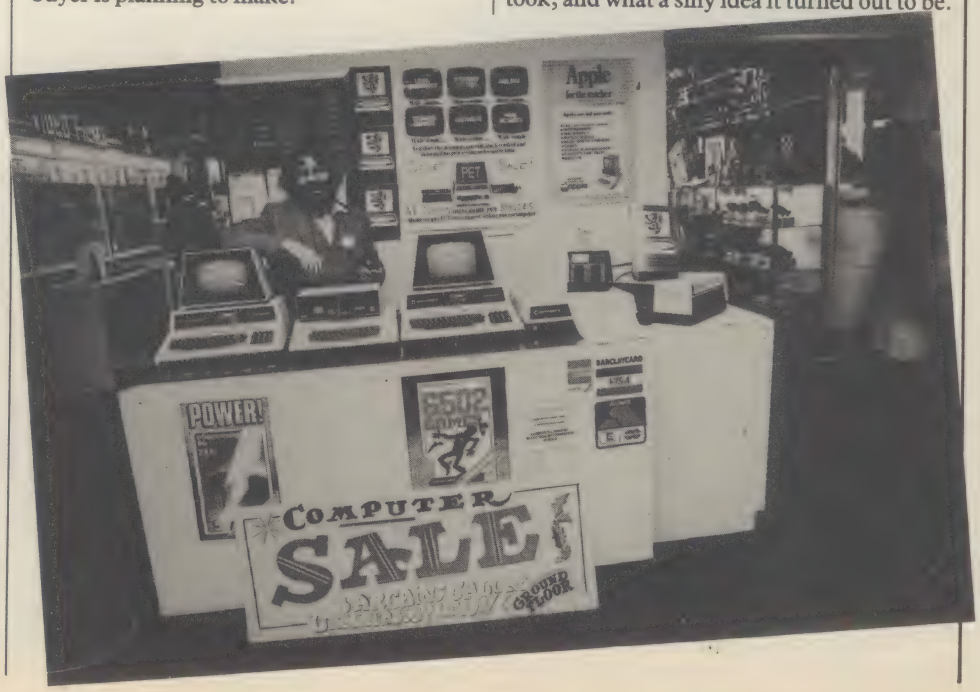
The best plan is to work through from where the questioner is – whether they have been reading an advert, and know nothing else, or whether they have bought a machine and are not sure what to do next, or whether they're about to sell their first machine, and want guidance on other pitfalls.

The beginner really should start off by asking: 'Do you know somewhere nearby, where I can play with several machines, and find out what sort of things they do?'

This is usually a nice, easy question to answer properly. The answer is: get hold of the ComputerTown UK! membership list, and get in touch with the local organiser.

The drawback to this answer is that not everybody will like the atmosphere of hobby enthusiasm that can be generated at computer clubs.

Nonetheless, they are sources of anecdotes. During coffee breaks in the evening's lecture, or demonstration, people will swap yarns about what they tried to do, how long it took, and what a silly idea it turned out to be.



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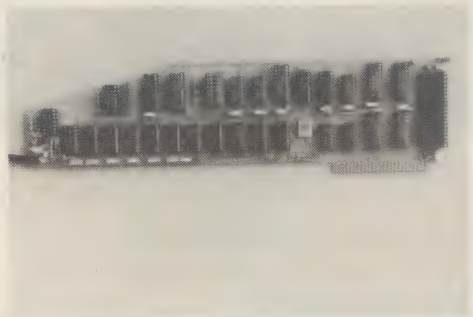

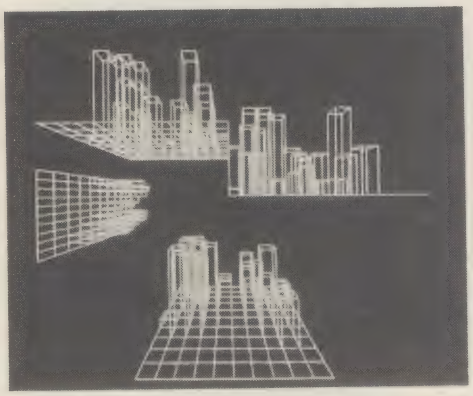

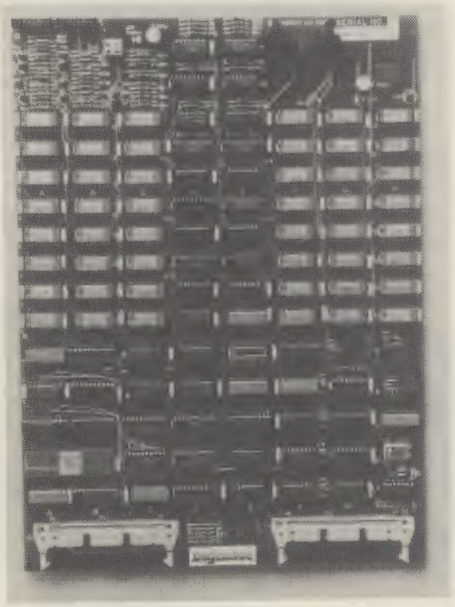

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They are also sources of computers. Not every computer retailer is clever enough to have a demonstration area where you are allowed to touch and fiddle. A lot of them actually have signs saying 'Do not touch and fiddle,' because this saves them having to keep stocks of spare diskettes to replace the ones customers destroy.

But you need to get your fingers on the thing before you start discovering questions about the hardware.

Hopefully, they are rather more sensible questions than embarrassing howlers like 'Where can I buy an IBM keyboard for my Sinclair ZX81?'

Once a potential user has some basic idea of what machines are on the market, the next question I'd like to be asked is the most important one of all: 'How important is price?'

Nobody ever asks that one, and they end up in the most hopeless tangle.

Price is the most important question of all, even more important than 'what software do I need?' because it influences so many others.

As a rule of thumb, it can be safely said that the cheaper the computer, the better. Given three machines that appear to do the same thing, buy the cheapest – because it will rapidly become the best.

Computers are like the old railway systems. Each computer is unique. Before standard gauge railways, you could not travel from London to Bristol, because the Paddington waggons could not travel beyond Swindon. They didn't fit on the rails. After standard guage, the wide wheeled waggons were scrap.

Buy a machine because it is the best, and 'I'd rather pay that little bit more for quality,' and watch yourself end up on a computer siding.

A lot of people are now trying to sell second-hand big microcomputers with ultra-reliable power supplies and multiple card-slot S100 frames because they started out with the theory that the Apple was just a toy, (judging on price) and they wanted something with a bit more quality because it would attract business software.

But the computer they bought didn't attract any software other than the manufacturer's own bought ledger program, which was never much good anyway even before the manufacturer discontinued it after version 3.

'As a rule of thumb, it can be safely said that the cheaper the computer the better. Given three machines that appear to do the same thing, buy the cheapest, because it will rapidly become the best'

There, we've come to software. Here, we can dispose of a whole host of questions. Do not ask 'How important is 16-bit?' or 'Can I get multi-terminal systems?' or 'What about memory expansion?' because all these are empty promises, most of the time. Instead, the question to ask is: 'Has it got Visicalc, and where can I see it being used?'

Questions about 16-bit are trade-engendered. Life will be much easier for the computer trade, when everybody has a 16-bit machine (say in four years' time). A 16-bit processor is one which can be much faster, and much easier to write programs on – but end users will hardly notice the difference because they almost never do anything which is affected by the speed of the chip inside the machine.

Programmers need 16-bit power to speed up the job of developing programs on a factory basis. One day, that will mean quicker supplies of new programs, and cheaper new programs. But not today.

Today, there are a lot of new machines with very impressive specifications, which when tested perform outrageously well. They do not have Visicalc.

When asked, the supplier will say 'Oh yes, we have Visicalc, look.' That is a demo, not a working program, and the working program is held up because there are still one or two faults in the machine which are confusing the man who is adapting the Visicalc code.

From that, you may see that the question of 'How fast is this machine?' is equally irrelevant.

What you should ask instead is 'How fast does it run Visicalc?' You will be fascinated to see the differences between two machines, each with the 'same' operating system and the 'same' chip, both running the 'same' program.

The one will display a whole screen full of data in a flash. The other will laboriously work its way down, line by line and column by column. Sometimes, it will be the fault of the operating system. Sometimes, the fault of the screen. And sometimes, it will be the man who is trying to adapt the Visicalc code, who gave up trying to do it properly, and bodged the job to get it done on time.

'If it has CP/M, does that really mean I have access to a whole host of powerful software?' Nobody ever asks that, but the answer is: No. It may be that CP/M code will very nearly run on your machine, with one or two small alterations.

But unless you are qualified to make those small alterations, the difference between a program that will 'nearly' run and a program which will not run at all is purely academic. The question to ask is : 'What CP/M programs have already been adapted to run on this machine?' The real trick is getting an honest answer.

CP/M is often, and usually rightly, used as a lure. A CP/M machine is a no risks machine, there's lots that's tried and tested that will run on it. You can afford to be lured if the machine is widely used.

'If I buy this machine that doesn't have a printer, I can always plug a printer in, can't I?'

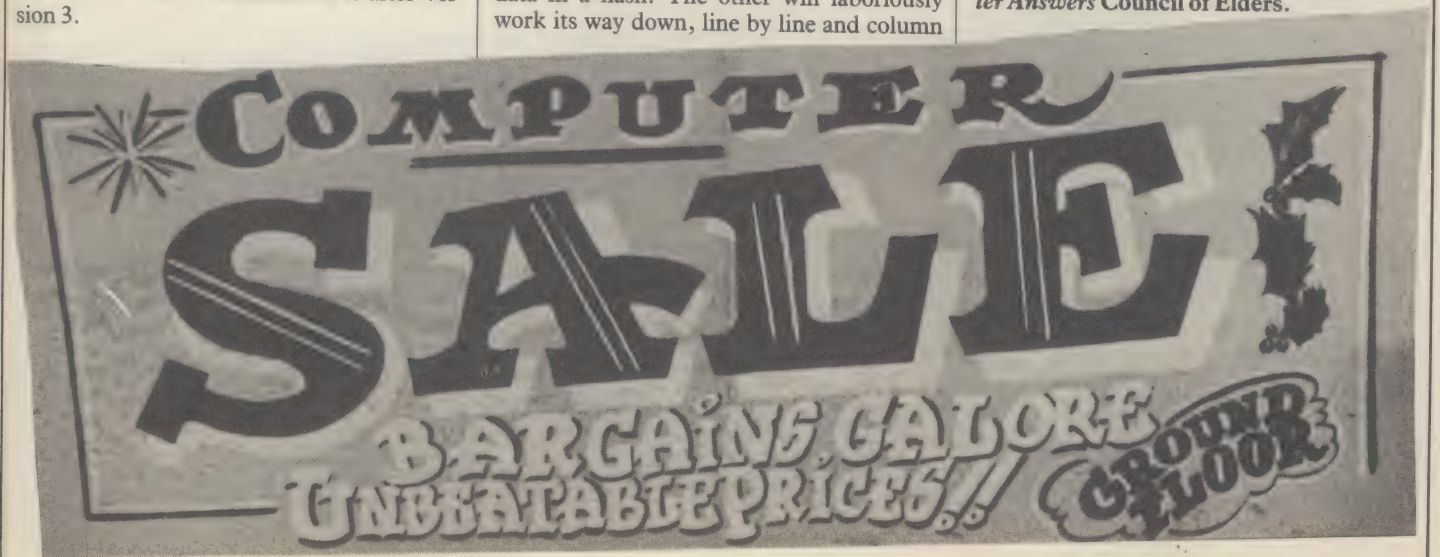
Only if you ask that question will you discover that the answer 'yes' is qualified by 'when you pay £100 for an extra circuit', more often than dealers will lead you to think.

The same question applies to 'Of course, I can add disks when I need them, can't I?' What you should ask is: 'How does this machine, once it has disks, or a light pen, or a bar code reader, or an IEEE 488 interface, or an Hebrew keyboard, or whatever fancy add-on you will one day need, compare in price with one that already has them?' Very often, it turns out that the light pen costs £15, but the extra controller circuitry costs £150, and needs a separate power supply and cable costing £30.

And then, of course, there's the necessary software, costing £120 (which will, no doubt, need only slight modification to run, since it's CP/M).

Please don't get the wrong idea. There are a lot of machines to which the answers to these questions are in fact acceptable. Just make sure you get one of those, and not one of the others.

By Guy Kewney, a member of the *Computer Answers* Council of Elders.



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HOW TO TEST SOFTWARE

Most people realise that the cost of a piece of software is a small fraction of the total cost of installing it. The balance is paid in sweat and blood. But faced with a bewildering variety of products, a buyer's reaction is likely to be 'well, if it only costs £100, why bother with evaluation?' I hope to persuade you not to follow suit.

Take accounting packages, for instance; at least a thousand products are on sale, of which (and erring on the side of generosity), about one in three can produce auditable accounts.

Of these, it is still necessary to identify one which is suitable, reliable and well supported. Depending on the 'routine-ness' of the application, the odds range from about 10:1 to 100:1 against hitting the jackpot with a random choice.

The comprehensive evaluation of a piece of software requires technical skills which are not readily available, and therefore expensive. So how can non-professional buyers hope to achieve anything useful, given that the cost of professional services is beyond them?

Well, just as one may get some idea of the condition of a motor car without an intimate knowledge of physics and mechanics, so the behaviour and external characteristics may be used to judge the overall state of affairs.

How can we 'lean' on a piece of software, and what should we hope to see? The headings for our check-list are: function, quality, support and compatibility.

Let us take function first. Before setting foot outside the door, and certainly before letting a salesperson in, you should think very carefully about what the software is required to do.

Make a list of the processes, together with inputs, outputs, timings, and volumes – a bit of DIY systems analysis.

If you feel at this stage that your organisation would benefit from some up-dated ideas, now is the time to catch up on your reading.

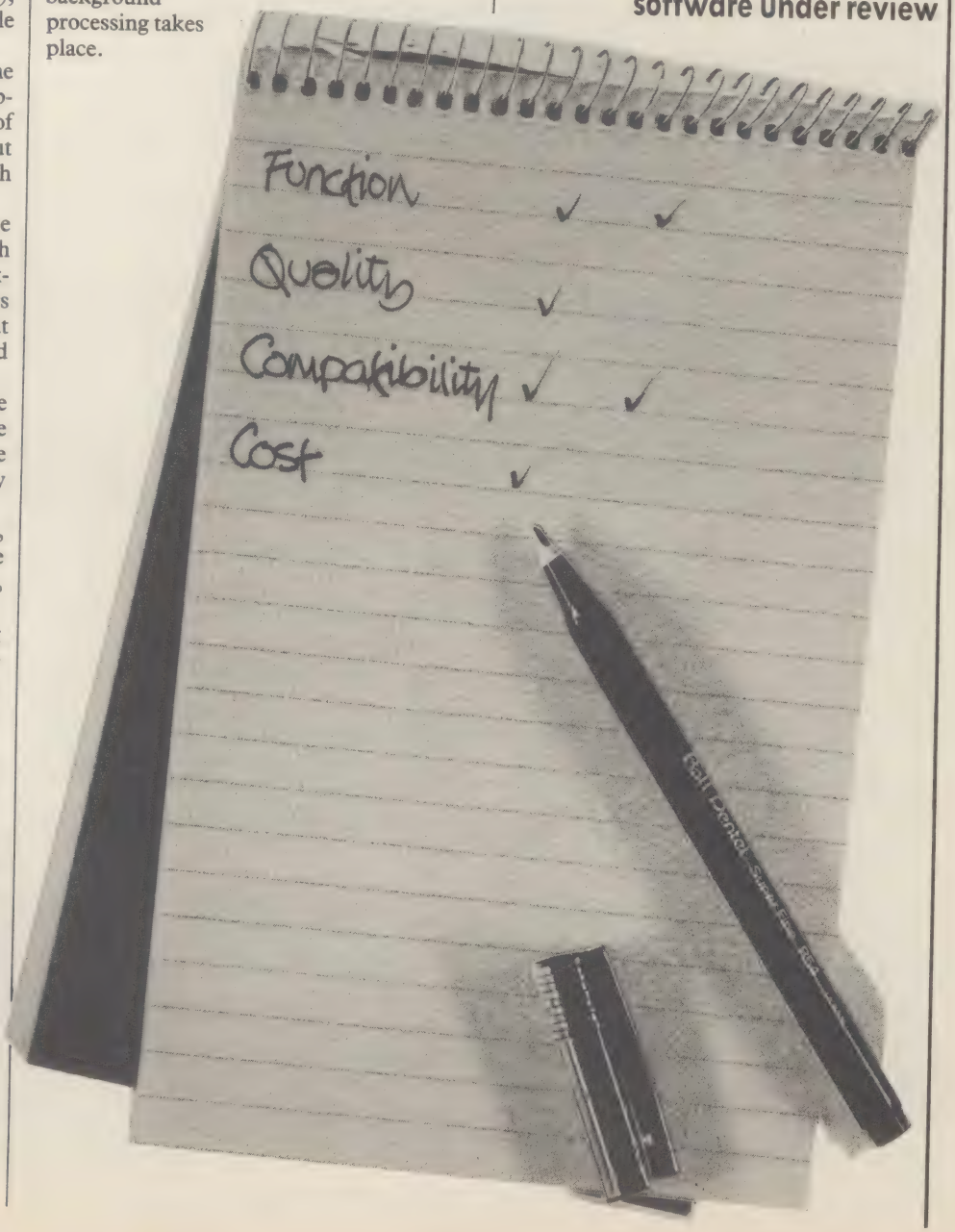
You might even risk attending an exhibition or two; remain incognito, if possible. If all the people who had ordered unsuitable systems from exhibitions were laid end to end, they would probably reach to Alpha Centauri.

This phase, defining the function, is hard work and takes a long time. Console yourself with the knowledge that systems analysts are paid lots of money to do the same thing.

Next, to assess the quality of the package. As with shock absorbers, we can do this indirectly. (It is assumed at this stage that a demonstration is available.) The point of attack is the 'user interface', that is, what you see on the VDU, and how it reacts when you press the buttons, especially the wrong buttons.

Look for consistency in screen layouts, helpful error messages, and informative comments if there is a long wait while background processing takes place.

Make a full list of your requirements and the points to watch out for. Leave space to record your comments and make copies of the list so you have one for each piece of software under review



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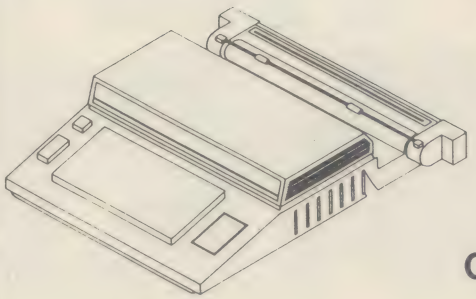

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Do put invalid data in and generate invalid transactions, or ask the demonstrator to do so. Do ask what happens if you pull the plug out or if your dog eats the systems disk.

Bear in mind also, that the demonstration is probably based on unrealistically small volumes of data.

You can take up the question of larger volumes with 'reference sites' – people who are using the product already in similar applications.

In assessing support, you are on firmer ground. Most of us have experience of buying a product which requires a life-time of support (cars, washing machines, and so on). Clearly you must determine the viability of the supplier, and how satisfied existing users are. It is quite legitimate, indeed essential, to ask for contact with reference sites.

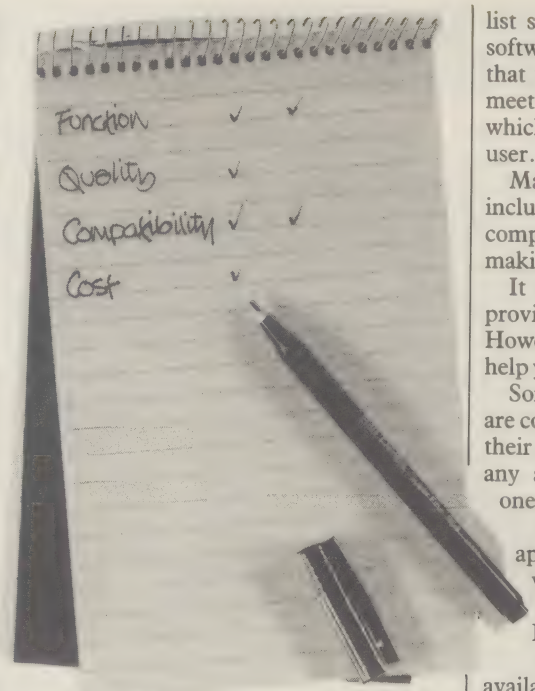
The lucidity of supporting documentation, and the arrangements for assistance during implementation are also factors to be considered.

The fourth heading in the check-list is compatibility. You should consider possible future applications, and how the new software would interface with them.

Since choice of software tends to restrict choice of hardware, it is also necessary to find out if the hardware can interface with other equipment if this will be needed.

If hardware interfacing requirements are complex, it is advisable to have professional help with the specification.

Make a list of your requirements and the various points to watch out for. Leave spaces to record your comments. make copies of the list so that you have one for each piece of software under consideration. It is unlikely that you will find something which exactly meets your requirements, so look for one which is designed to be 'customised' by the user.



Make a note of the costs, and what they include. Then make detailed and objective comparisons of the possible system before making your final choice. This should help you avoid the worst pitfalls.

Make a note of the costs, and what they include. Then make detailed and objective comparisons of the possible system before making your final choice.

It is impossible in this short article to provide an exhaustive list of what to look for. However, this methodical approach should help you to avoid the worst pitfalls.

Some professional and trade organisations are concerned with the computing interest of their members. It is worth checking whether any advice is available from the relevant ones.

If you want to familiarise yourself with applications software in a neutral environment (that is, without sales pressure), then the Microsystems Centre in London is worth a visit.

A wide range of applications software is available which you can 'drive' yourself with the minimum of assistance. Entrance to the workshop is free. And if you want advice on software, consultancy is available on a fee-paying basis.

By Patricia MacConaill, senior consultant, the National Computing Centre Manchester.

* The Microsystems Centre (part of the National Computing Centre) is on 01-353 0013.

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Q&A

LEGAL FILE: SOFTWARE OVERSELL

If I am looking for a piece of software to run a particular application, what recourse do I have if the package I buy proves ineffective?

Suppose, as well, that I get a quote from a supplier which represents its product as a perfect solution?

It seems possible that the package won't live up to expectations.

It may even damage the data I have collected and used with it. What can I do then?

Buying the wrong software for your system, especially when it is used with precious data, can prove extremely damaging. You may have spent months collecting the data, it may be vital to the running of a business (for example if it's used in stock control), and once lost, it may be irretrievable.

If someone oversells you something, for example by telling you that a program is capable of performing a particular task when in fact it could never cope with such a work-load, then that person is 'misrepresenting' the facts to you.

The *Computer Answers* Legal File offers you access to a member of the legal profession who has experience of microcomputing. Charles Christian is a qualified barrister and a writer. He will be using his knowledge of Britain's impenetrable legal system to help answer your questions. If you want to access the Legal File, please use the Question Card bound in with this issue.

Consequently, if the only reason you bought the program in the first place was because you relied upon the misrepresentation and in due course it does let you down, then in law you have a number of remedies at your disposal.

Without getting bogged down in too much detail, because this is a particularly confusing area of contract law, you would be entitled to sue the software house either for 'recission', which means that the contract between you would be cancelled and you would get the money back that you paid for the software. Or, if it is not possible to go back to the position you were at before the program was purchased, you can sue for 'damages', in other words, you can get financial compensation for any losses you may have incurred while attempting to run your stock control on their program.

Hopefully, either way, although you will have wasted your time, you should not end up out of pocket. One word of warning in advance – always try to get any company to confirm its 'promises' as to performance and contractual arrangements in writing.

This will considerably strengthen your hand if future arguments degenerate into 'your word against theirs'.

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Moving-key keyboard with auto repeat on every key and

ory mapped 32 column x 24 line flicker-free display with
er case ascii character set.
unky graphics (64 x 46 pixels) may be plotted, unplotted
(XOR operation). Also, the entire character set (128
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rawn with a resolution equivalent to 256 x 192 pixels.
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grams and data in the compact dictionary format may be
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rt Contains D.C. power rails and full Z80 Address, data
nals. May be used to connect extra memory and other
and OUT words allow port-based peripherals to be

es Integer, Floating point and String data may be held
ariables or arrays with multiple dimensions and mixed
ere are no restrictions on names.
tures **IF–ELSE–THEN, DO–LOOP DO–+LOOP,**
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e closely follows the FORTH 79 standard with extensions
nt, sound and cassette. It has a unique and remarkable
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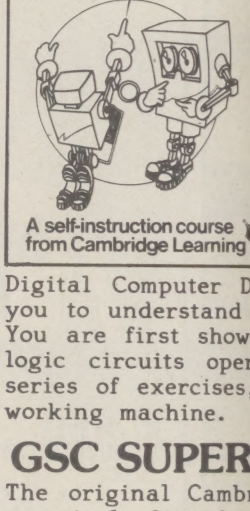

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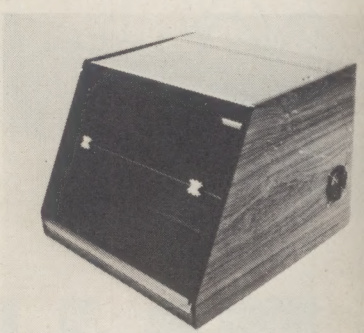

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